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GROUNDING THE FRAMES OF ALTERNATORS.

There is still much dispute among central station men as to whether the iron framework of alternators should or should not be grounded. There are arguments to be made on both sides. The principal argument for grounding alternator frames is that, in the case of high-tension alternators, the attendants are liable to receive a dangerous shock from accidental contact with the frames, a condition impossible if these frames are permanently grounded. The principal argument for not grounding the frame is that such grounding increases the dielectric stress upon the insulated winding in the machine and tends to increase the risk of damage from lightning, static high-potential or internal short-circuit. The question is by no means of recent utterance. In the early days of electric arc lighting twenty-five years ago it was the rule to mount high-tension arc generators on wooden bases, to lay mattings of insulating material around them, and to direct the attendant in adjusting any part of the machine to keep one hand in the pocket. Now, however, pressures have increased to such a degree that the only safe procedure is to keep both hands in the pockets and keep the pockets away from the machine unless the machine framework is permanently grounded.

As a choice between protecting employees from injury on the one hand, and protecting dynamos from injury on the other, the former is the only logical, humane and defensible selection, as soon as the voltage developed by the dynamo becomes dangerous to life. Not only is it a kinder selection to the attendants, but it is also the more economical. The increase of risk to the insulation of the dynamos is quite small if the machine is well built and the lightning arrester and static arresters are adequately installed. If however, the machine framework is not permanently grounded and an attendant should be injured by shock in any way, either in the ordinary performance of his duty, or against rules, a jury is likely to bring a verdict of damages against the owners of the power station. The only defensible course is to save humans even if you wreck machines. Generator frames, switchboard frames, transformer frames should all and always be grounded in high-tension systems.

THE EFFECT OF THE READINESS-TO-SERVE RATE ON COMMERCIAL LIGHTING.

We have recently printed accounts of a number of central stations in southern Wisconsin which have adopted the readiness-to-serve method of charging for electric energy, as modified by Mr. H. L. Doherty. This method of charging, which is almost too well known to need description, as applied in these cities consists in a readiness-to-serve charge of 15 cents per month per 16-cp lamp connected, plus a service charge of $1 per month. In view of these readiness-to-serve charges, which are supposed to take care of interest on investment and cost of maintaining service at a customer's premises, the rate per kw-hour for energy as measured by the meter is usually low, being 5 or 6 cents per kw-hour. Customers have usually been given the option of this system or a rate of from 10 to 15 cents per kw-hour with a

minimum bill of $1 per month. The readiness-to-serve system has never been popular among residences for the simple reason that its fixed charges amount to more than the bills would come to under the old meter rate. The ones to gain by it have been the stores, restaurants, saloons and other long-hour users. It is interesting to note that in a small city where stores close at 6 o'clock with the exception of one or two nights a week, the merchant who is paying 12½ cents per kw-hour is not able to save much if anything by changing to the Doherty rate if his kw-hour consumption remains the same as it did before. However, if he wishes to go into evening window display lighting or to keep his store partially lighted during the evening as an advertisement even though it is not open, the readiness-to-serve system gives him a chance to do it at a much lower price than he would have to pay at full meter rates. It is here that the true value of this system appears, namely, that it encourages the long-hour use of current, and in the end raises the standard of illumination in the business part of a town, so that the gross revenue, even though temporarily curtailed by the sudden adoption of the system by a large number of long-hour users will, in the end, far exceed what it could have been under a continuance of the old rate system.

Illumination as a Practical Art.

Considering that artificial illumination must in a certain sense have been coeval with civilization, and that, therefore, the art of illuminating has been practiced since prehistoric times, it is wonderful how slow has been its progress from an economical or technological standpoint. It is only occasionally that we find ourselves in a hall, building or enclosure where the lighting at night is at once sufficient, agreeable, and economical. Oftentimes we find an abundance of illumination, but with so much glare in the eyes that they are pained. Often again the light may be pleasant, but the illumination is insufficient for the practical purposes to which the building is devoted. Finally, we frequently meet cases where the light has been installed economically from the standpoint of maintenance, but the contrasts and shadows are distressing. The art of modern illumination consists in giving adequate illumination everywhere in a graceful, uniform, convenient and pleasing manner, with the minimum waste of light, and the minimum expense of installation, maintenance and depreciation. One of the most distressing defects frequently observed in lighting is that the luminous source is dazzlingly exposed to the eye, instead of being concealed from direct vision. "Let your light so shine before men that they may see your good works," and not your naked incandescents or arcs, should be the rule of the illuminating engineer. The sun sets us a shining example in this matter. At noontide, in the fullness of his power of about 10^{27} standard British candles, he occupies a position outside the ordinary range of view, so that we see everywhere objects sunlit with a mean illumination of about 7,000 candle-feet. When, on the contrary, he sinks at evening into the normal field of view, he interposes hundreds of miles of absorbent air between the tangentially viewing observer and himself, so that the eye is no longer blinded by the glare.

How different is this practice from that of those designers of a theatre who hang, almost in the line between the stage and its observer, a large cluster of vivid incandescent lamp filaments, having brightness of maybe 40 candles per sq. cm. of surface. The retina of the eye is unable to withstand this glare, so the iris diaphragm or pupil of the eye automatically contracts. The observer then sits for several hours trying with pin-point pupils to watch closely the picture presented on the stage beyond, and goes home wondering why he feels so fatigued. Occasionally we see an attempt made to ameliorate this condition by the employment of frosted incandescent lamp globes, or of frosted outer containing globes. Although these present an enlarged aspect, they are more tolerable to the retina, because the brightness of the light may be cut down to a maximum of only a few candles per square centimeter of emitting surface. But the frosting absorbs an appreciable portion of the total light emitted, so that the benefit to the optic nerves of the observer is not gained without waste. Only at rare intervals do we enter a hall where the light is not only diffused and spread uniformly, but the lamps themselves are concealed from direct vision. When this is skillfully done we not only rejoice in the effect produced, but we unconsciously give salutation to the appreciative care and technically trained forethought of the illuminating engineer.

The same physiological law necessarily pervades the whole domain of domestic lighting. We want to secure a clear picture on the retina of each object we look at in turn, be it a book page or a wall portrait. In order to secure this picture on the retina with a reasonable minimum of artificial light production, we need the pupil to be kept widely opened or the iris diaphragm left large in aperture. If this condition is to be brought about we must cut off all bright lights or luminous sources from direct admission to the little camera of the eye. This means that the incandescent lamps must be so placed, or shaded, or englobed, that they will not irritate the retina. One of the principal advantages of the incandescent lamp over the gas lamp is that it permits of being so treated to a very marked degree. In fact, it is impossible to secure from gas lighting in general, the same pleasing, decorative and shaded effect that electric incandescents can be made to furnish with a little care and attention to detail. It pays the central station manager, therefore, to study the rules of physiological lighting, or hygienic lighting, because once the public has been cultivated to appreciate the æsthetic and healthful capabilities of electric lighting it will not hesitate to adopt incandescent lighting in preference to illumination by flames.

Levelling the Central Station Load.

The pet abomination of every central station man is the peak. It looms, forbidding, before his balance sheet, it throws a sinister shadow across his path even at noonday, and renders gloomy the approach of sunset. His most earnest desire is somehow to get out from under it or to get it out of the way. Now there are two ways in which one can remedy inequalities; one can cut down the hills, and one can fill in the valleys. If fortune favors indeed one can combine the processes and use the cuts to furnish material for the fills. In central station working likewise the same processes can be carried out. Peak load can be discouraged, off-the-peak load can be built up, or part of the peak can be transferred. If one carry the analogy a little further it will be seen that as regards the general level, cutting down the peak must be accompanied by filling or the total average load will fall. Filling, however, of necessity raises the average load. In central station work raising the mean load means an increase of more or less profitable business irrespective of its nature, provided that the relative height of the peak is not unduly increased. As the central station business has been carried on, we are inclined to think

that the proper balance between cuts and fills has been often lost sight of to the detriment of the business.

Any plan which starts on the theory of penalizing peak load as such is strategically bad. It may be successful in reducing the peak, but it is exceedingly likely at the same time to reduce the valley level as well. Hence two-rate meters and modifications of demand systems introduced specifically to hit the peak load have been in practice only moderately successful. Unhappily almost every common kind of load holds over the peak to a certain extent, but every sort of constant load which holds over the valleys as well helps out, by reducing the proportionate height of the peak. Perhaps the motor load is as good an example as any when properly developed. The frequent trouble is, however, that it is not properly developed for the purpose in hand. The little motor of a horse-power or two pegging steadily along hour after hour is from the load standpoint by far the best thing to cultivate, but a very brief study of rates as they are worked will disclose the fact that the small motor business is not pushed as it should be, while larger motors, often on elevator or other work which has a more or less conspicuous peak, is taken on in rather large amounts. Of the lighting load something quite similar holds good. An office building has perhaps the most formidable peak to be found in the case of any customer, and yet it is not infrequently taken aboard at a very low figure, lest an isolated plant should go in. The thousand and one little shops that keep open through the evening are highly desirable from the standpoint of load, but in most American cities where does their custom go?

The answer is, very often, it goes to the gas company. Too many central station managers hold the opinion that the small consumer is a creature not to be encouraged, and so he makes cheap rates to a department store that shuts down promptly at 6 o'clock, and allows the little fellow who uses light five or six hours per day to burn Welsbachs, which he does, to be sure, very cheerfully. And has he ever noticed that the gas company, many of whose largest customers he has skillfully gathered in, has had to lower its dividends because of said manager's aid in loading it up with "unprofitable" small consumers? Electric signs have proved an excellent load to encourage since they hold over well into the evening, but has a thorough canvass been made to see what all day or all night business can be captured? The investment represents the peak load, while the receipts represent the average load, and the time has now come when it will pay the central station manager to make a note of this fact and pin it in his hat. A careful study of the uses of electricity will disclose the fact that there is a large aggregate amount of odd business of various sorts, how odd and queer only the canvasser can ever properly appreciate, which can be secured by persistent effort, and which holds pretty steadily through the day or night as the case may be. Lamps, small motors, heaters for various purposes, even minor electrochemical processes, all add their quota to the possible steady load. And there is, too, a chance in some places for getting load which is distinctly specified as off the peak. In some localities this is taken on in considerable amounts and at good profit. It is excellent filling material even at a moderate profit and should not be neglected. The long and short of it is that in hunting new business it is not always the easy and obvious thing that pays—attention devoted to the unusual and unexpected will often result in every desirable additions to the total load.

The Handling of Sign Business.

The development of electric sign and display lighting has been remarkable in a number of cities, but is only in its first stages with respect to the country as a whole. The question of how best to develop this kind of business among the merchants in a town and what system of rates to adopt is being considered in a number of places. Several methods of handling this business are in use. The most common method is to connect the merchant's sign and display lighting on his regular meter, allowing the merchant to look after the time of cutting in and out his signs and window displays. The merchant may have a time switch to cut out his lighting at whatever hour he desires, or a private patrolman employed by a number of merchants on a street may have this added to his duties. Another common plan and one that has been used by a number of companies which have made a most notable development of their sign and display lighting business, is to make a contract with a merchant or other customer for a certain number of sign or display lamps to be burned a specified number of hours per year at a fixed price for the term of the contract. The hours of burning specified in the contract may be from dusk to 11 p.m. or any other hours which local conditions seem to suggest as profitable. The company then has a patrolman whose duty it is to turn on and off these lights at the specified hours every night. Since the company has control of the switches on these lights and is able to calculate in advance the number of hours of burning per month, meters are unnecessary on this class of business. Various modifications of these two plans suggest themselves. For example, the display lighting might be on the customer's meter, but the company might maintain a patrolman to turn it off and on according to contract. In case the company did not care to keep a patrolman on this kind of work, the company might install its own time switches to do this.

Where sign business has not been very fully developed by a central station company, it is usually being done on a meter basis and is entirely under the control of the merchant. This has the advantage from the central station man's point of view that it does not necessitate any special looking after by the company, as the customer takes care of his own sign and sees that it is turned on and off. Sign business can, as a rule, be got on the customer's regular meter rates only when some system of charging is in vogue whereby a low rate is given for long-hour business; otherwise the cost of operating signs and window displays or anything taking energy after business hours is likely to be looked upon by the merchant as prohibitive. Assuming, therefore, that the regular rates for long-hour business are low enough to put sign lighting within the reach of the merchants, is it better to take sign lighting for a given number of hours per month at a flat rate equal to the regular meter rate for an equal amount of consumption, or should it be left to the merchant to handle the load on his existing meter? The greatest objection that has been found with sign lighting when not done on a flat rate contract and turned on and off by the company, is that the merchants attempt to economize by turning off sign and display lighting many times when otherwise if on a flat rate under contract for a certain number of hours' burning they would not be turned off. The practical result of this is that the company loses revenue from sign lighting which it would get under a flat rate. It is probably true that some merchants can be induced to put in a sign, the operation of which is under their

own control so that they can use it as little or as much as they please. It is equally true that many merchants will prefer to make flat rate contracts for a certain amount of advertising by means of sign and display lighting rather than purchase sign and display lighting equipment without a definite idea of how much it will cost them to operate it.

It is to the central station company's interest to have all the sign and display lighting on a street in operation every night as long as people are on the streets, not only on account of the revenue from this lighting, but because of the effect it has on other merchants on the street in inducing them to make their places of business attractive by night. Another strong point of the flat rate sign scheme is that by making a long time contract with a merchant, say for two years, the price of the sign can be included in the contract and a good sign customer secured where the first cost of the sign might sometimes prevent. Some managers are opposed to flat rates as being a step backwards, but where the burning of sign and display lighting is absolutely under the control of the company and the flat rate made is calculated to be equal to the company's regular meter rates for a similar use of energy, there can be no possible objection to it other than the cost of labor involved in turning these lights on and off. Some companies have tried time switches as substitutes for patrolmen and others solenoid-operated switches on a special switch circuit controlled at the central station or some convenient central point. These plans have certain advantages in saving of labor, but are open to the objection that a sign is not inspected by an employee of the company twice a day as it is when a patrolman visits each installation in person to turn it on and off. In fact, it is one of the strong points of the flat-rate system with patrolmen that sign and display lighting is carefully watched and burned-out lamps replaced either the night they are noted or the next day. In this way signs can be kept in first-class condition and be a good advertisement for the electrical advertising business, whereas a sign with one or two lamps burned out presents such a dilapidated appearance as to be anything but a recommendation for electric sign advertising. It is one of the objections to the system of having signs controlled by the customer that they are not watched as closely as when controlled and maintained by the company.

Natural Gas Competition.

Our Kansas central station friends are at the present time going through an experience which is similar to that of Indiana and Ohio central station men at the time the use of natural gas was introduced in those States. A brief review of the effect of natural gas upon central station business in Indiana and Ohio will therefore be of interest not only to Kansas central stations but to stations in any part of the country where cheap gas competition exists. In Indiana natural gas is no longer a factor in the situation, the supply being almost exhausted. While obtainable the gas was used recklessly, and being sold very largely on flat rates, the waste was so enormous that the supply did not last nearly as many years as it would have done under more conservative use. Whether this will be the history of the natural gas business in Ohio and West Virginia remains to be seen. It is also impossible to tell whether new gas fields may be opened up. Natural gas is not being used in Ohio with such waste as it was in Indiana, as it is being sold largely by meter. However the rate is so low that it is lavishly used. It is the testimony of central station managers, borne out by our observation in Ohio cities served by natural gas for three or four years past, that natural gas competition cuts but little figure in the case of residences in which electric light is already in use and in the better class of stores. In the smaller stores and saloons, natural gas used in mantle burners is so ridiculously cheap that it is difficult for electric service to stand out against it because in such places there is but little consideration given to the questions of general appearance, ventilation, heat and inconvenience. An amusing aspect of the situation is that not only can a small storekeeper flood his store with light from natural gas mantle burners at a ridiculously small price when gas is selling at 30 cents per 1,000 cu. ft., but he can also practically do without other means of heating in the winter. What these places with their numerous gas jets are like in the summer can well be imagined.

This brings out another interesting phase of the situation, which is that some stores use so-called gas arcs in winter both for heating and lighting and take central station service in the summer because of the heat of the gas burners. The condition of the air in stores in the latitude of Ohio which are heated by means of gas burners throwing all the products of combustion out into the room, can well be imagined. The air is fit for no human being to live in and the clerks in these stores show it. These store owners would probably stand aghast at the idea of having their houses equipped with natural gas furnaces, the products of combustion which usually go up the stove pipe to the chimney discharging into the living room. They would probably not permit such a furnace to be installed even under their stores, but still cling to the idea that it is economy to heat and light their stores in a manner which is the equivalent of the method mentioned as far as the pollution of the air is concerned. The effect of this custom of using electric light for store lighting in summer only is so pronounced in some cities that some central station companies have their maximum peak load in the down-town district in the summer rather than in winter. All over the state of Ohio in buildings where natural gas is used there is the same indefinable smell due to the products of combustion thrown off from gas burners. This smell together with the inherent inconvenience of lighting gas with matches and the ruining of interior decorations is keeping the natural gas out of residences wherever the central station companies are reasonably wide awake. In the better class of stores and in window display and sign lighting, electricity still has things its own way. The most wide awake managers in the gas districts fully realize that residence lighting is the bulwark of their business which neither natural gas nor isolated plants can ever be able to take away from them, and they are making corresponding efforts to extend that business.

Natural gas also is a serious competitor of the power department of the central station business. Gas engine salesmen are, of course, active, and as far as the bare cost of gas is concerned, the gas engine can be operated very cheaply on 30-cent natural gas. It is usually only a question of time, however, until the user of the small gas engine has trouble with it, either mechanically or electrically. It is also a decidedly disagreeable thing to have on the premises with its unremitting coughing and banging, and the employee whose duty it is to start the thing occasionally gets thrown violently against the wall by a back

kick or something of the sort. Taken altogether, by watchfulness and persistence on the part of the central station manager or solicitor the gas engine power user can frequently by being approached at the right time be brought over to central station service. Small isolated gas engine driven electric lighting plants are quite common but the service from these is so poor as regards steadiness of light and occasional interruptions to service, that it is indeed a hard customer who will not in time come to the central station.

As to just how much influence the incoming of cheap natural gas will have immediately on any given central station company's income, depends very much on the character of the town and the character of the load which the company has built up. We have in mind one small manufacturing town with a large number of small stores and saloons and but little residence lighting where the central station's gross revenue was reduced about 25 per cent the year natural gas came to the town. If a central station company is depending for a large percentage of its income on the cheap class of stores and has neglected the residence lighting and allowed the stores to put in isolated plants, it is apt to be in a bad way when natural gas strikes the town, unless it begins promptly to push its residence lighting business and to get all the possible power users on to central station service before they are induced to change from steam engines to gas engines. If the company has the residence district well covered, has developed its power business as it should so that it is turning nearly all the wheels in the town and has a good lot of electric sign and display lighting, its revenues should not suffer seriously. If rates are reasonably low, it is not advisable to lower them with the idea of meeting natural gas competition, because the natural gas is so very cheap that if it is a question of price only, certain customers will be lost anyway, while the customers who consider electric light on its merits will usually pay the old rate just as willingly as any reduced rate. It is, of course, well for the manager in a town about to be invaded with natural gas to look well to his customers' installations to see that they are getting the best results possible for their money; and if inexpensive changes can be made, as they frequently can, which will give much better results, the customer should be persuaded to make them rather than to pipe for gas. In fact, in many cases such changes could well be made by the company subject to the customer's approval, as the amount of money involved would not be large in case the changes were not acceptable.

The Outlook for Central Station Business.

It must be apparent to any one who makes a tour of inspection of a number of central stations of all kinds and sizes selected at random in any part of the country, that there are great undeveloped possibilities in the central station business when the total results are averaged up. He will find a central station in one city developing certain classes of business and neglecting others equally as good. In the next town he will find the conditions reversed. If we add up the possibilities of development of a number of central stations, the results are startling in their magnitude. Large numbers of companies have not given the attention to building up a residence lighting business which they should. There are large residence areas in many cities in which no electric light service wires can be found. Residence lighting may require a little more investment for a given number of customers than down-town lighting, but it is nevertheless a most desirable kind of load when secured in sufficient quantity. Like any other business it is not profitable if carried on in a small and scattered way. A large number of companies have not developed a respectable power load, which is due partially to inactivity, and partially to a system of rates which practically keeps would-be power customers away from central station service. Sign and display lighting for advertising purposes by merchants in down-town districts is a source of revenue which is but little worked in the majority of places, although there are striking examples of what can be done with it in some cities. In a large number of small towns there is no day service, although by proper effort a good day load could be secured. In this connection there is frequently a chance to secure a contract from the city for pumping water. Such work can be economically done by a central station when the station capacity is not needed for other work, and is a great help to a small plant as well as an economy for the city. In every live town there should be a demand on the part of the merchants for higher standards of illumination from year to year. The well lighted store of ten years ago is not a well lighted store to-day, and there are plenty of stores to-day which need brightening up. Of course, in some of the larger cities a few stores have about reached the limit of possible useful or display illumination, but these exceptions do not prove anything against the general assertion that there is every reason to expect greater expenditure of money from year to year by the merchants in any given town for illumination. It is for the central station companies to work up the matter and get merchants in their respective cities into a more liberal use of light, not only during open hours but after stores are closed in the evening.

Besides these thoroughly demonstrated possibilities along lines which have been worked out by the more progressive companies, there is the electric heating business to figure on in the immediate future. Of the revenue producing heating devices, the electric flat iron has already begun to show results to central station companies which have had the foresight to actively push its use. A good increase in the day load of central stations can certainly be looked for from this quarter if only the companies will make the effort to get these flat irons on their circuits. Besides this there are the other smaller cooking and heating devices which, while not great revenue producers, are good advertisers for the business and all help to swell the gross receipts. The field of heavier cooking is also undeveloped but will undoubtedly become an important source of revenue, though perhaps not in the immediate future. We have mentioned here only common, well known branches of the central station business. Attention has been called to them hundreds of times in the technical press and before conventions. We know nevertheless that the majority of central station companies are weak along certain lines and are neglecting some of the branches of the business named. Some are neglecting some lines; their neighbors are neglecting others. To sum up, if all the companies would work all of the branches within reasonable limits there would be such a growth of the central station business as has never been witnessed since its beginning.

Intelligent Use of Electric Supply.

Mr. E. R. Weeks, past president of the National Electric Light Association, at the recent annual meeting of the Manufacturers' and Merchants' Association of Kansas City, delivered an interesting address on applied electricity. He criticised the uneconomic work done on and by many plants, and said: "Ignorance of good practice in electrical engineering is equally expensive to the merchant. Since he usually has no knowledge by which to determine the kind of machinery best suited to his needs or the proper cost of its operation, he, too, is at the mercy of unscrupulous vendors of current and apparatus. A certain hydraulic elevator in this city is now costing $3.49 per car mile, while an electric elevator in the next block, with one-third more load, costs by meter only 36 cents per car mile. On the other hand, a new pair of lifts operated by electricity at 4 cents per kw-hour by meter, was recently costing $350 per month, while another pair of purely mechanical lifts doing much more work were costing only $142 per month. After thorough test and reconstruction, the cost of running the pair of electrics dropped to $65 for last month, although the service had increased 10 per cent."

As to the beauty and value of electrical products, and the fine skill needed in their manufacture, he remarked: "As manufacturers and vendors of industrial products, it will interest you to hear that in the electrical arts is now found the most costly pound of manufactured product. It has long been supposed that a pound of hair springs has the greatest pecuniary weight; being at wholesale rates, $42,000. I feel sure that those among you who have paid this price will be surprised at the statement of fact that the wholesale cash value of one pound of carbon filaments for incandescent lamps is $60,000, or 199 times its weight in gold. Some of you who are accustomed to buy and sell by the car load may think that the purchase of one pound of a commodity should be called a retail transaction; but when I state that 42,000 hair springs or 30,000,000 filaments are required to balance a pound of butter, I think you will all agree that even as small a weight as an ounce of either would constitute a wholesale consignment."

Ohio Independent Telephone Association.

At the annual meeting of the Ohio Independent Telephone Association, held at Columbus, Ohio, March 29, the attendance was but little short of 500. President Beam in his address stated that the independents in Ohio have made remarkable strides during the past year and that investment in the State is more than $30,000,000, and Secretary Reamer reported that 135 out of the 325 independent companies in the State were members of the Association. President James R. Hoge, of the National Interstate Telephone Association, presented a paper on "National Development and Progress of the National Interstate Telephone Association," in which it was stated that independent trunk lines now extend from Albany, N. Y., to Kansas City, and that about 3,200,000 independent telephones are now in operation. In the larger cities the independents are increasing their business at from 500 to 1,000 telephones per month, and the independent movement is progressing at a rapid rate in the New England States. Mr. Hoge advocated that particular attention should be given to developing farmers' lines.

The Association took prompt action concerning a bill in the Ohio Legislature, the passage of which would inflict a tax of $1 per telephone in the larger cities of the State. A committee and members of the Association acting individually, opposed the measure, and though reported from the committee it was defeated on the floor. Resolutions were adopted expressing the dissatisfaction of the independent telephone interest on the manner in which it had been treated in Cincinnati, all efforts to establish an independent telephone system there having been persistently opposed. Mr. W. B. Woodbury, of Detroit, said that everything looked favorable for the establishment of one of the finest exchanges in the country in that place, and Mr. Edward L. Barker reported that the first long-distance line to the Gulf would be completed in about four months and that another line is complete to Birmingham, Ala., and will be continued to the coast. A discussion brought out that independent telephone securities have largely enhanced in public estimation during the past two years, and in another discussion there was a consensus of opinion that intercourse should be withdrawn from all independent companies using the Bell long-distance lines.

The following officers were elected for the ensuing year: President, Mr. Frank L. Beam, Columbus; secretary, Mr. O. Welsheimer, Columbus; treasurer, Mr. Ralph Reamer, Cleveland. In the evening a banquet was served at which Hon. H. M. Daugherty presided as toastmaster. Among those responding to toasts were Mr. Frank A. Davis, of Columbus, and Col. J. D. Powers, of Louisville.

Report on Niagara Falls Power.

The International Waterways Commission has made a report to the Secretary of War on the preservation of Niagara Falls, and this report has been transmitted to Congress. Some practical suggestions are made as follows: "The Secretary of War be authorized to grant permits for the diversion of 28,500 cu. ft. per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows: Niagara Falls Hydraulic Power & Manufacturing Company, 9,500; Niagara Falls Power Company, 8,600; Erie Canal or its tenants (in addition to lock service), 400; Chicago Drainage Canal, 10,000.

"All other diversion of water which is naturally tributary to Niagara Falls to be prohibited, except such as may be required for domestic use and for the service of locks in navigation canals. Suitable penalties for violation of the law to be prescribed.

"The foregoing prohibition to remain in force two years, and then to become the permanent law of the land, if in the meantime the Canadian Government should have enacted legislation prohibiting the diversion of water which is naturally tributary to Niagara Falls in excess of 36,000 cu. ft. per second, not including the amount required for domestic use or for the service of locks in navigation canals. It is assumed, however, that an understanding upon the subject should be reached by treaty. The object of such legislation would be to put a stop to the further depletion of the falls and at the same time inflict the least possible injury upon the important interests now dependent upon this water power.

"The amount to be diverted on the Canadian side has been fixed with a view to allowing to the companies on that side the amounts for which they now have works under construction, which are: The Canadian Niagara Power Company, 9,500; Ontario Power Company, 12,000; Electrical Development Company, 11,200; Niagara Falls Park Railway Company, 1,500; Welland Canal or its tenants (in addition to lock service), 1,800."

The report states that the amount of flow thus far diverted on the American side has been only 27,800 cu. ft.

Tests of a 500-Kw. Westinghouse-Parsons Turbine.

A test of a 500-kw Westinghouse-Parsons steam turbine was recently made at the East Pittsburg works of the Westinghouse Machine Company by Ludwig & Company, Engineers, of Atlanta, Ga. The turbine was designed to develop normally 750 brake hp with a steam pressure of 175 lbs. at the turbine throttle, 150° F. superheat, 28-in. vacuum absolute, and running at a speed of 3,600 r.p.m. The tests were made to determine the fulfillment of the builders' guarantees and the general running qualities of the turbine under ultimate conditions of service. The turbine was subjected to different loads by means of a water absorption break. The data of the test are plotted in the ac-

companying curves, and some of the numerical results are given in the following tables:

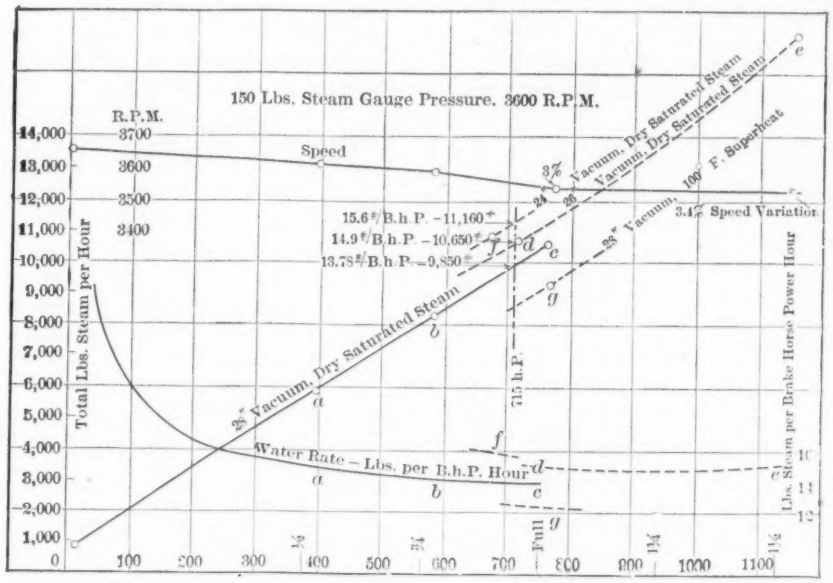
SATURATED STEAM.

	Full Load.	¾ Load.	½ Load.
Lbs. per hp-hour from test.....	13.68	14.05	14.92
Corrected for 28-in. vacuum.....	13.47	14.05	14.92

SUPERHEATED STEAM.

	Full Load.	¾ Load.	½ Load.
Lbs. per hp-hour from test.....	12.7	13	13.8
Corrected for 150° superheat.....	11.7	13	13.8

The tests showed that the steam consumption decreases about 10 per cent per 100° F. of superheat, and numerous tests have shown that the steam consumption of this type of turbine changes



PERFORMANCE OF WESTINGHOUSE-PARSONS TURBINE.

from 3½ to 4 per cent per inch of vacuum. The no-load steam consumption was found to amount to 7 per cent of the full load consumption with saturated steam. Assuming that this percentage remains constant up to full load, the practical efficiency of the turbine will be 93 per cent and the steam consumption per indicated hp-hour will be 12.7 lbs. of saturated steam, and 10.75 lbs. with 150° superheat.

The extreme speed variations were 2.3 per cent from ½ load to 1½ load; 3 per cent from no load to full load, and 3.4 per cent from no load to 1½ load. With the full load suddenly turned off and on, the extreme speed variation from no load to full load was 3 per cent and from full load to no load 2.6 per cent. During this test the safety stop with which the turbine is equipped to prevent racing in the event of any accident to the governor mechanism, operated at 3,780 r.p.m., or about 5 per cent above the normal running speed of the turbine. The tests showed that under practical conditions of service (where the vacuum is liable to fall from 28 to 26 in. on overloads) the steam consumption of the turbine between ½ load and 50 per cent overload varied by only 4½ per cent from the average, and probably with a uniform degree of superheat the variation would have been still less.

CURRENT NEWS AND NOTES.

CHICAGO MUNICIPAL TROLLEYS.—By a referendum vote the people of Chicago have declared this week in favor of the municipal ownership of the street railways, but against their municipal operation. The question of issuing $75,000,000 worth of Mueller law certificates was also answered in the affirmative, the majority being 3,339. The Mueller law, which lacks the authority of the Supreme Court and the validity of which is open to some doubt, is a legislative act passed several years ago, authorizing the issuance of "certificates," a sort of bonds to be used for the purchase of public utilities by any city wishing to go into the business.

SCIENCE AND SPIRITUALITY.—At Bristol, England, on March 30, Ambassador Whitelaw Reid, speaking at a university dinner, drew an interesting comparison between the educational progress in Great Britain and the United States. In England, he said, the tendency of university courses was now becoming more in the direction of scientific and technological knowledge, but in America the belief was growing that it might be advantageous to give greater attention to old studies, pure scholarship and literature, and that scientific education might be carried too far for the best interests of the rising generation. "In my belief," said Mr. Reid, "the time can never come when spiritual things will not outweigh those merely material."

NIAGARA FALLS WATER POWER.—The Ottawa Board of Trade has adopted a resolution declaring that the Canadian Government should not enter into any arrangement that would interfere with the right of Canada to develop water power at Niagara Falls, or at any other point along the international boundary. The resolution declares that "in view of the fact that the Province of Ontario is largely dependent upon foreign coal for industrial and domestic purposes" it should develop its water power. The resolution also called on the Canadian Government to enact legislation to prohibit manufacturers of electric energy in Canada from selling and transporting the same across the border under any contract not terminable within one year.

TELEPHONY IN CANADA.—Advices from Toronto state that the Dominion Government has abandoned the proposal to nationalize the telephones of Canada, and has adopted the policy of bringing the Bell and its competitors under the control of the railway commission. The rates will be supervised, the Bell exclusive rights to enter railroad stations cut off, and the company be compelled to give connections with independent companies. Movements are on foot in Ontario, Quebec and Manitoba looking to the provincial or municipal ownership of all the telephone lines, but it looks as if the Federal Government will refuse power to expropriate. The Grand Trunk Railroad, it is said, has decided to spend $300,000 in equipping its lines with telephones.

MUNICIPAL ELECTRICIANS.—The eleventh annual convention of the International Association of Municipal Electricians will be held at New Haven, Conn., August 15, 16 and 17, 1906. At this meeting the following papers will be presented and discussed: "History of the Fire Alarm and Police Telegraph," "Details of Certain Auxiliaries to Fire Alarm Apparatus," "Advisability of Protecting Municipal Electricians by the Civil Service Laws," "Comparison of Underground and Overhead Wiring, and of the Relative Values of Single, Rubber-covered Wire and Lead-encased Cable for Underground Construction," "Conditions Surrounding the Inspection of Wires in the Southwest." In addition to this the Question Box will be a feature at the meeting. Mr. Frank P. Foster, Corning, N. Y., is secretary.

STEAM TURBINE INVESTIGATION.—The name of Mr. W. E. Moore, of Connellsville, Pa., has been added to the committee for the investigation of the steam turbine, which is to report at the Atlantic City meeting of the National Electric Light Association. In order to complete the data for the report, the committee met this week at the office of Mr. Irving E. Moultrop, in Boston. Mr. Moultrop has just returned from Europe, where he went for the purpose of gathering data regarding turbine operation abroad. From Boston the committee will visit the General Electric Works at Lynn, Mass., and the Providence Engineering Works, Providence, R. I. It will then proceed to Schenectady for a day at the General Electric works, will visit Utica, Chicago and Milwaukee, and on the return trip will visit the works of the Westinghouse Company at Pittsburg. The coming report is expected to contain much matter not heretofore published.

TROLLEYS IN JAPAN.—United States Consul-General Miller, of Yokohama, reports that a scheme is on foot among members of the Osaka City Council to organize an electric railway company to run between Osaka and Kyoto. The capital stock proposed is $2,500,000. This is encouraging, as the electrical activity in Japan slackened somewhat with the cessation of the war.

THE OHIO ELECTRIC LIGHT PROCEEDINGS.—D. L. Gaskill, Greenville, O., secretary of the Ohio Electric Light Association has just issued the *Transactions* of the last annual convention. These proceedings were considerably delayed in appearance by the loss of some of the papers in transit and by a general printers' strike at Cleveland where the work was being done. The book is bound in board covers in convenient shape for ready reference.

INCREASE IN LOAD.—The Janesville (Wis.) Electric Company, between January 1 and March 10, in a town of about 10,000 inhabitants, secured 15 new residence customers, 8 commercial lighting customers and 9 power customers. From January 1 to March 1 a special offer to residence customers was in force giving them 50 per cent reduction on bills for the first four months if connected during that period. It would be interesting to know how many other central stations can show an equal growth in communities of the same size.

CARNEGIE TECHNICAL SCHOOL.—It is announced that Mr. Andrew Carnegie has given $2,000,000 in addition to previous gifts for the maintenance of the Carnegie Technical Schools. Mr. Carnegie has already given more than $1,000,000. None of the latest gift is to be used for the erection of buildings. It is also announced that Mr. Carnegie expressed a desire that the Margaret Morrison Carnegie School for Women be completed as soon as possible, and assured the committee that he would meet the expense. It is expected the technical schools will have cost about $5,000,000 when completed.

STREET RAILWAY MEETING.—Secretary B. V. Swenson, of the American Street and Interurban Railway Association, has issued a preliminary announcement as to the 1906 convention. It will be held at Columbus, Ohio, October 15-20. The city has four first-class hotels guaranteeing about 1,100 rooms, and accommodations can be reserved now by addressing Mr. B. H. Harmon, secretary convention committee, Columbus Board of Trade. The exhibit halls will be on the State Fair grounds, about 15 minutes' ride from the principal hotels, and the convention hall is in close proximity to the exhibits. Current at 500 volts direct and 110-220 volts, 60-cycle, alternating, will be available. Detailed plans and days for the parent and associate bodies will be announced in due course.

ELECTRICAL METHOD OF MAKING ARMOR PLATE.—A patent recently issued to Lieut. Joseph Straus, of the United States Navy, describes a method for electrical manufacture of armor plate. The desideratum of armor plate is an exterior sufficiently hard and thick to prevent penetration of projectiles striking it, and having a tough inner portion capable of withstanding the racking strains to which the plate is subjected from the impact of projectiles. Armor plates in the past have been constructed to fulfill these conditions by a cementation process producing a decremental carburization of the plates from the outer face inward, or by fastening to a large body of soft steel small plates of hard steel. The process of Lieut. Straus is for producing a composite armor plate like the last mentioned, in which, however, the small hard plates are united to the large tough body piece by electric welding. By this means not only can a very perfect union be secured but there will be a diffusion decrementally of carbon from the hard small plates to the large plate of tough steel, this diffusion of the carbon being controlled by proper manipulation of the temperature of the plates.

CIVIL SERVICE OPENINGS.—The United States Civil Service Commission announces an examination May 2 for six vacancies as electrical assistant in the Signal Service at Large, at $900 per annum salary. Applicants should be thoroughly familiar with the practical side of electricity as applied to telegraph, telephone and cable engineering, and also with the methods of testing and installing electrical instruments used in fire control, such as storage batteries, telegraphs, electric clocks, telephones, etc. Age limit, 20 years or over on the date of the examination and applicants must be citizens. The commission also announces a vacancy in the same force as assistant electrical engineer, at $1,400, for which post examinations will be held May 3-4. There seems to be difficulty in filling the positions at the lower salary. All who wish to undergo the examination at any of the designated centers should apply to the commission offices, Washington, D. C., for the necessary forms, etc.

PRODUCTION OF HIGH VACUA.—A recent patent granted to Prof. James Dewar, of Cambridge, England, describes an interesting method for obtaining very high vacua. This consists in placing the receptacle to be exhausted in connection with another receptacle containing charcoal, and then subjecting the latter to very intense cold by immersing it, for example, into a vessel containing liquid air. When air is the gas to be absorbed, as in the manufacture of incandescent lamps and Röntgen ray tubes, the following data give an idea of the proportion which the charcoal should bear to the volume of air to be absorbed when liquid air is the cooling agent: A vessel containing 1,500 cm. of air at atmospheric pressure was put into communication with 30 grammes of cocoanut charcoal placed in a side vessel immersed in liquid air. The pressure within the vessel fell to 50 mm. of mercury. When by means of a pump the same vessel was exhausted by half an atmospheric pressure before the charcoal was cooled, the cooling lowered the pressure to a vacuum higher than that in which an electric discharge produced the well-known striae. When the pump was operated to reduce the pressure to one-quarter atmospheric pressure before the cooling, the latter produced a vacuum in which it was exceedingly difficult to get an electric spark to pass.

ELECTRIC IRONS IN A CLOTHING FACTORY.—One of the clothing factories of Goldsmith, Joseph, Feiss & Co., at Cleveland, Ohio, has 95 electric irons in use for pressing. This firm also has another smaller establishment in Cleveland using electric irons. The irons are mostly of 16 lb. weight, and are of Simplex manufacture. They are used on pressing tables which are equipped with swiveling arms on which the irons are placed. The pressing tables can be raised by a foot treadle so that the operator has a minimum of manual labor to perform, as he has merely to swing around the iron (the weight of which is taken by the swiveling arm) and raise the table so as to bring pressure up against the iron by means of the foot treadle. That electric irons should be used on such a large scale in a factory of this kind speaks volumes for its advantages. The reasons for the adoption of electric irons in the factories of Goldsmith, Joseph, Feiss & Co. are, first, the reduction of fire risk, because no matches are necessary; second, saving of time as compared to charcoal heated irons; third, absence of damage to goods, and fourth, no pollution of the air because of the irons. If a gas iron with gas jet inside the iron were used the workman would have to have matches, which in itself would be a considerable fire risk where so much lint exists as in a clothing factory. There is also some danger of scorching the work with a sudden puff from such a gas-heated iron, when it is used rapidly. These gas irons are also objectionable in such a factory because of the air they pollute. Charcoal heated irons were considered out of the question as compared with the electric because of the pollution of the air and the large amount of time lost in refilling them and getting them at the right heat. There is no doubt that the factory is able to turn out much more work than with any other kind of iron. Electricity for this factory is supplied by the Cleveland Electric Illuminating Company. A number of other factories in Cleveland are also using electric irons.

MULTIPLE-UNIT, SINGLE-PHASE CONTROL.—It is reported by the London *Electrician*, that Messrs. Siemens Bros. & Co., have obtained very promising results from experiments with an electro-pneumatic multiple-unit control equipment for single-phase motors.

ELECTRIC TRACTION COMMANDED.—The New York State Railroad Commission has just recommended, after an examination of the traffic conditions, that the New York City Railway Company install electricity on several street car lines on the lower east side of Manhattan Island. It is high time, indeed, that the last street car horse was banished from New York City.

NEW YORK TRAFFIC.—In 1905 no fewer than 93,000,000 street railway passengers paid fare in New York, in excess of the number in the preceding year. The State Board of Railroad Commissioners made public last week a compilation of statistics of the number of passengers carried and transferred on the street surface, elevated and subway railroad lines of New York City during 1905, as compared with 1904. The number of paid fares was 1,171,151,698, an increase of 93,493,451. The number transferred was 271,195,524, an increase of 7,816,362. The car mileage was 230,249,455, an increase of 28,664,543.

PROTECTION OF WIRES.—The Waddell bill introduced in the New York Assembly provides a clause in the penal code as follows: "Every person who knowingly, or without authority of the owner or managing owner thereof, or who maliciously takes down, removes, injures, interferes with or obstructs any line erected or maintained for the purpose of transmitting electricity, or any part thereof, for any purpose whatsoever, or any insulator or cross arm, appurtenance or apparatus connected therewith, or severs or in any way interferes with any wire or cable thereof, is punishable by imprisonment in the State prison not exceeding five years, or in the county jail not less than six months."

ILLUMINATING ENGINEERING SOCIETY.—The April meeting of the Illuminating Engineering Society will be held in the Edison Auditorium, 44 West 27th Street, New York, on the evening of Thursday, April 12. The programme of the evening is a discussion of the subject of "Interior Illumination." Three short introductory papers will be presented by a gas engineer, an electrical engineer and an acetylene engineer, respectively. Invitations have been issued to gentlemen representing the several interests among the membership of the Society to take part in the discussion, which will then be made general. The membership of the Society is growing rapidly, the total enrollment to date being 320.

A CHALDAIC CRYPTOGRAM is cleverly contrived to catch the curious, in a cream-colored circular issued by the Chicago Edison Company. It was originated and copyrighted by Messrs. D. H. Howard, of the company, and H. A. Seymour, who edits the local Edison bulletin called *The Electric City*. When a man has mastered the muddle of marks he makes out a mysterious monition to be wise, by using central station current. We are informed that these folders, the ingenious inscription on which only becomes legible when held up to the light, can be obtained in any quantity from the publishers on request, for use as a supplement to monthly Bulletins, or to be used separately as an advertising folder to be sent to a selected list.

THE COAL TAR INDUSTRY.—This year is the jubilee of the epoch-making discovery by William Henry Perkin of the dyestuff "mauve," by which the foundation was laid of the coal tar industry and great stimulus given to the study of organic chemistry, and chemistry in general. Thus the modern progress in the manufacture of synthetic medicines, photographic developers, artificial perfumes, sweeteners, and explosives is entirely due to the original work of Perkin. The Chemists' Club of New York City is to hold a meeting at its house on April 7 at 8.15 p. m. to consider what steps should be taken to associate this country in the proposed celebration in England and Germany. General and executive committees will be formed.

KITES FOR WIRELESS.—A special dispatch from Washington, D. C., for March 27 says that Dr. Alexander Graham Bell's tetrahedral kite was put to use on that day in some remarkable experiments at Arlington with wireless telegraphy. Dr. Bell loaned one of his largest kites, having 230 cells, which was operated by W. F. Bedwin. The kite was sent up 2,000 ft., and from antennæ 400 ft. long messages were caught and transmitted down over a steel wire. Messages were received from the United States naval wireless station at the Washington Navy Yard, from the DeForest station at Galilee, N. J., near the Atlantic Highlands, and from the steamer Bermudian, 100 miles out from New York and more than 350 miles from the kites. At the end of the wire stood A. Potter of the United States Weather Bureau, with one hand on the wire. His other hand clasped that of G. D. MacDonald, representing Mr. Bell. Mr. MacDonald had hold of the receiver, so that the operator caught the messages from the kites 2,000 ft. in the air through the bodies of the two men. Long messages were sent and received.

CENTRAL'S HIGH VOLTAGE CABLES.—Commissioner Ellison, of the New York City department of water, gas and electricity, has declined to issue a permit to the New York Central Railroad for carrying its 11,000-volt cables overhead along the line. He defines his position as follows: "The public rides over the road, even if it is excluded from walking along the right of way. Therefore the public is entitled to protection, and it would be in serious danger if the wires were placed overhead. The falling of a single one of those heavy voltage wires would cause serious damage, and possibly great loss of life. In the Bronx, the road in many cases crosses thoroughfares at grade between Mott Haven and Spuyten Duyvil. It is too bad to knock out the entire plans of the Central people, but I feel that the people must be protected, and I do not think they would be protected if this permit were granted by me." The attorneys for the New York Central may begin mandamus proceedings against the Commissioner.

ATLANTIC WIRELESS.—The subjoined statement has been given out by the De Forest Wireless Telegraph Company regarding wireless communication with Dursey Head, South of Ireland, the home of Lord Armstrong, president of the English De Forest Company, from the company's station at Coney Island. "Wireless communication with the old country is yet to become an established fact. We have succeeded in reaching a point on the southern coast of Ireland with the wireless, but only as an experiment. During this past week a number of words, in code, have been intelligently sent by wireless from our station at Coney Island to a receiving station at Lord Armstrong's castle in the south of Ireland. We haven't yet established a sending station on the other side. We learned by cable of the success of our experiments. Our operator at Coney Island in communicating with Ireland was furnished with an exact programme, which he followed out to the minutest details. Each code message was sent at a five-minute interval and each time in a different key, pitch or tone. The reason for this is that every specific distance seems to have a key, pitch or tone of its own, which must be established by experiment. For instance, if our operator at Coney attempted to send a message to Boston and Philadelphia simultaneously on the Philadelphia pitch, Boston would complain that it was getting its message in bad shape. If the Boston pitch were used, Philadelphia and all the shorter distance cities might intercept the message. We only await now the equipment of the sending stations in Ireland to complete a transoceanic communication. Our experiments have proved successful beyond our most sanguine expectations."

TROLLEY EARNINGS.—The dividend payments in April for street railways for the March quarter are estimated at $5,791,840. This would appear fairly correct. The total dividends reported for 1902 amounted to $15,882,110.

TROUBLES IN RUSSIA are recrudescent, but the government is taking some new precautions. A plan has been worked out for a wireless telegraph system in case of another strike of the railroad and telegraph operators, and soldiers are being taught how to operate the telegraph lines.

CHICAGO MUNICIPAL LIGHTING.—The council has appropriated the $500,000 asked for by William Carroll, city electrician, to reconstruct the city arc lighting system so as to utilize the power offered the city recently by the trustees of the Drainage Canal from the new water power plant near Lockport.

SEATTLE PUBLIC OWNERSHIP.—Mayor Moore in a message recommends that popular vote be taken to decide if the city desires to construct and own new extensive street car system. He says no important route should be given away meanwhile to the Seattle Electric Company, now operating a system.

ELEVATED FOR CINCINNATI.—While other cities are going in for subways, Cincinnati is to have an elevated electric road, and a bill has been introduced in the State Senate to give authority for the erection of an overhead road from one of the suburbs to the downtown business district. A company has been formed.

SOLDERING ALUMINUM.—A solder for aluminum has been invented, says United States Consul Atwell, of Roubaix, France, by Fernand Hecht, a mechanic of that city. With a soldering iron he can join together two pieces of the metal or join aluminum to copper, brass or iron. The invention is simple, no acids or salts being used. Mr. Hecht exhibited his process satisfactorily before the professors of chemistry of the Faculty of Science, and was also awarded a medal from the Northern Industrial Society of France for making a discovery of great importance.

GREAT TROLLEY NETWORK.—It is announced from Cleveland, Ohio, that a consolidation of 541 miles of Illinois and Wisconsin traction lines, with more than $20,000,000 capital, is contemplated by Cleveland capitalists who are identified with the recent merger of the Aurora, Elgin & Chicago Railroad Company; Elgin, Aurora & Southern Traction Company, and the Cook County & Southern Railroad Company, making 154 miles of track. The projected consolidation will afford continuous traction connection from the heart of Chicago west to Dubuque, Iowa, north to Madison, Wis., and south to Plano and Joliet.

HOUSEHOLD MOTORS IN FRANCE.—United States Consul Covert reports that during the months of July and August, 1906, there will be held at Lyons, France, a general exposition of all electrical devices that can be applied to domestic uses. It will be conducted under the auspices of the Agricultural and Scientific Association of Lyons and no motor will be accepted for exhibition which is over 1 hp. The object of the exhibition is to bring cheap electrical appliances nearer to the people in order that the great mass may derive some benefit from them—motors that may be used on embroidery, sewing and knitting machines, ventilators, vacuum carpet and rug cleaners, house cleaning machines, floor polishers, carts for transporting objects, turning spits in cooking, etc. Motors for weaving are excluded. They have been in use in and around Lyons for the last three years, and it is deemed advisable to have an exhibition at an early day exclusively for such motors. Lyons is in a position to benefit greatly from cheap hydro-electric power.

NIAGARA POWER.—President Roosevelt has recommended Congress to act promptly for the preservation of Niagara, without waiting for a Canadian treaty. From the Dominion it is announced that steps will be taken to stop Niagara power exportation. The matter arose in a discussion at Ottawa on a motion by Mr. Monk for a return describing all water powers under Dominion control. Mr. Hyman, minister of public works, said there was no doubt of a federal control over the export of electric power. The government had therefore lain down a policy to govern their courses, several applications being now before them. Right to export power would only be granted subject to revocation at short notice; there would be no claim against either provincial or Dominion Government arising out of such revocation, and the companies would be subject to such rules and regulations as the government saw fit to impose. Action would also be taken to prevent spoliation of the scenic beauty of the falls.

POWER FROM COKE GASES is discussed in a report from U. S. Consul Wallace, of Crefeld, Germany. One of the coal mine companies operating in the district manufactures coke and has almost completed the erection of a large electric power plant to deliver electric current to cities and villages within reach. This company purposes to utilize the hot gases formed in the manufacture of coke to drive the dynamos of its plant. The coal and coke company can produce, by this plan, electric current for commercial purposes very cheaply, and, as the plant will be an alternating-current system, the firm is contracting to deliver it to important places at a distance. The city of Crefeld has completed a contract with this company to have electric energy delivered supplying all its needs at a price much lower than the city could supply it; and the city officials are rejoicing that the occasion presented itself to them at such an opportune time. The distance from the electric plant to Crefeld-Linn and the harbor territory is about 10 miles, but the contract with the city is made to cover a large additional district, which is to get electric energy cheaper than the plants in operation can make it under the old system.

ELECTRIFICATION IN ENGLAND.—Discussing at some length the general subject of electrifying steam railroads in England, the London *Statist* says with regard to the Great Eastern Railway: "Another railway which has been considering the question of electrification, to which allusion has more than once been made in the chairman's reports, is the Great Eastern Railway Company. Here the prime difficulty is not as yet the loss of traffic to competing systems, nor is it so much the desire for increasing their traffic or reducing their working expenses, which were the main causes of the electrification schemes already carried out. It is rather the increasing difficulty which is being experienced in coping with the suburban traffic, which is constantly increasing in magnitude. Those who remember Liverpool Street Station when it was first completed are aware that it has been again and again extended at enormous cost, and that this has been almost entirely necessary for the purpose of handling the suburban traffic, which the company's energetic policy has built up. In addition to this, the company has widened its carriages and provided more powerful locomotives, and in some cases, we believe, lengthened its platforms; but it is doubtful whether any of these expedients can be more than temporary, and whether something more radical will not have to be done. At one time it was proposed, in view of the competition of another line, to lay a second line underneath the present one; but the experience gained by those companies which have already converted their systems would appear to show that electrification is the most probable solution of the difficulty, and we anticipate that in time that will be the one adopted. The general manager has, however, recently stated that at present the company is not satisfied that any of the existing systems of electric traction offer sufficient advantages to induce them to adopt it or to make them certain that the improvement effected by its adoption would be sufficiently lasting and complete to justify the change."

The Nassau (L. I.) Light and Power Company.

THE central station of the Nassau Light & Power Company at Glen Head, Long Island, furnishes an interesting example of unlooked-for development in the electric light and power field in rural districts. Six years ago a number of wealthy men having country seats near Roslyn wishing electricity for their residences and finding no station to supply it determined to build a station to supply their collective wants rather than to install individual isolated plants. In order also to remove the station as far as possible from their dwellings it was determined to build the station on Hempstead Bay, near the present site, and to install two-phase alternating-current apparatus. Property on the bay front, however, took a jump of over 500 per cent in value when the owners found who the prospective purchasers were to be, and a station was built on the line of the Long Island Railroad on the outskirts of Roslyn. Coal could then be easily obtained and wells were driven to supply the water necessary for the operation of the plant. Before building operations had begun the towns of Roslyn and Mineola requested to be supplied with electricity for street lighting and a plant having a capacity of 1,000 hp was erected. The company at that time had a capital stock of $100,000.

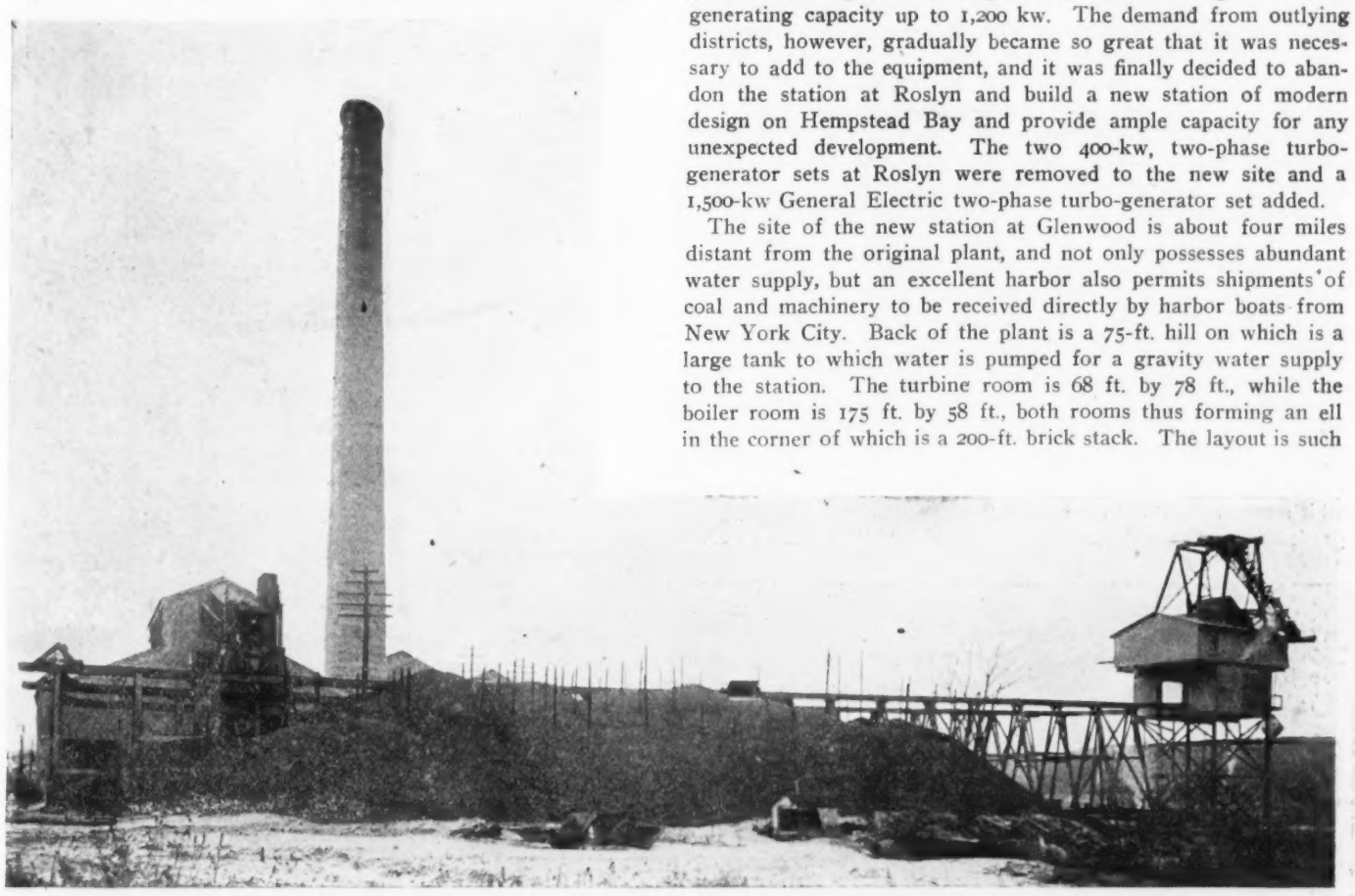


Fig. 1.—Power House of the Nassau Light and Power Company, Showing Coal Storage Equipment.

The growth of the company since then has been very rapid. The North Hempstead Light & Power Company, and the Municipal Electric Light Plant at Hempstead were giving a very unsatisfactory service, and these were absorbed and the energy for lighting and street car motors supplied from Roslyn. Shortly after the Franklin Electric Illuminating Company was absorbed and the name of the Roslyn Light & Power Company changed to the Nassau Light & Power Company and the capital stock raised from the original $100,000 to $2,000,000. A new station was erected on Hempstead Bay in the village known as Glenwood, and sub-stations maintained at Roslyn, Oyster Bay, Port Washington, Hicksville, Hempstead and Great Neck. These sub-stations, together with the main generating station, supply electric energy to Baldwins, Floral Park, Glen Cove, Glenwood, Great Neck, Hempstead, Hicksville, Hyde Park, Mineola, Port Washington, Roslyn, Sea Cliff and Westbury. The near-by towns are supplied with two-phase current as heretofore, while two-phase current is stepped up and transmitted as 6,600 three-phase current to the distant towns. The territory covered comprises a large section of the central portion of Long Island, and being of a suburban character involves distribution in a large number of sparsely settled villages.

The equipment at the original station in Roslyn consisted of one 100-kw and two 150-kw belt-driven alternators, the engines being operated condensing and involving the use of water-cooling towers. The output was increased in 1903 by the addition of a 400-kw Westinghouse turbo-generator, which brought the total generating capacity up to 1,200 kw. The demand from outlying districts, however, gradually became so great that it was necessary to add to the equipment, and it was finally decided to abandon the station at Roslyn and build a new station of modern design on Hempstead Bay and provide ample capacity for any unexpected development. The two 400-kw, two-phase turbo-generator sets at Roslyn were removed to the new site and a 1,500-kw General Electric two-phase turbo-generator set added.

The site of the new station at Glenwood is about four miles distant from the original plant, and not only possesses abundant water supply, but an excellent harbor also permits shipments of coal and machinery to be received directly by harbor boats from New York City. Back of the plant is a 75-ft. hill on which is a large tank to which water is pumped for a gravity water supply to the station. The turbine room is 68 ft. by 78 ft., while the boiler room is 175 ft. by 58 ft., both rooms thus forming an ell in the corner of which is a 200-ft. brick stack. The layout is such that when the present building becomes inadequate the structure may be duplicated by the addition of a 175-ft. boiler room and a 68-ft. turbine room to the south.

The power house is of steel frame construction, the roof trusses being provided with monitors for lighting and ventilation. The turbine room has a main roof span of 44 ft. and two bays each 18½ ft. wide. The central portion has a clear height to the bottom of the roof trusses of 36 ft. to permit the use of a central traveling crane; the east bay has a clear head room of 24 ft., while the west bay has three galleries which are devoted to the electrical control equipment, transformers and auxiliary apparatus. Over the center of the top gallery is a cupola which rises above the level of the roof and serves as a wire tower for the outgoing distribution lines. The boiler room involves similar construction, but has a larger roof monitor in order to accommodate the coal distribution conveyor. This monitor is 20 ft. wide and 10 ft. high and is heavily braced to carry the additional load. The roof structure also carries the additional load of a row of elevated coal storage bunkers which are arranged over the firing floor in front of the boilers as shown by Fig. 2. The roof trusses are reinforced on this side and are assisted in

carrying the weight by 12-in. girder posts rising at each side of and in the middle of the boiler settings. An unusual feature of the boiler house construction is its width, a clear space of almost 20 ft. being provided between the rear of the boilers and the division wall. This space is reserved for the possible installation of fuel economizers, the use of which was carefully considered in the original design; but is not as yet warranted. Everything has been arranged, however, so that their installation is possible and at a minimum expense. On account of the low cost of the site this extra space could easily be provided, and is at present being used by a well-equipped machine shop containing a lathe, drill press, pipe threading machine, emery wheel, forge and the necessary tool equipment. An electrically-driven pump is also located in this space and supplies the tank on the hill opposite which furnishes the water supply at the plant.

The plant is peculiarly situated as regards coal supply. The site has no railroad connection so that fuel must be brought by boat or carted from the railroad four miles away. There is a minimum depth of water in the channel opposite the station of from 8 to 10 ft. at mean low tide so that the ordinary coal canal boats are easily accommodated. The bay is, however, frozen over in the winter months, making navigation impossible, and a large storage yard has, therefore, been provided at the northerly end of the site. This yard has a maximum storage capacity of 8,000 tons and embraces a wharf 110 ft. wide and projecting out 90 ft. from the shore line, with coal-handling equipment for unloading barges and delivering coal to the boiler room. This amount of coal is more than sufficient to operate the station during the two or three winter months when the bay is liable to be frozen over.

The coal-handling equipment and coal storage yard are shown by Fig. 1. Coal is stored on a level platform of filled ground 220 ft. long and 90 ft. wide, extending from the front of the boiler house to the wharf. The coal is delivered by dumping cars which travel on three lines of elevated track. The trestles are graded for uniform slope so as to permit the loaded cars to drift

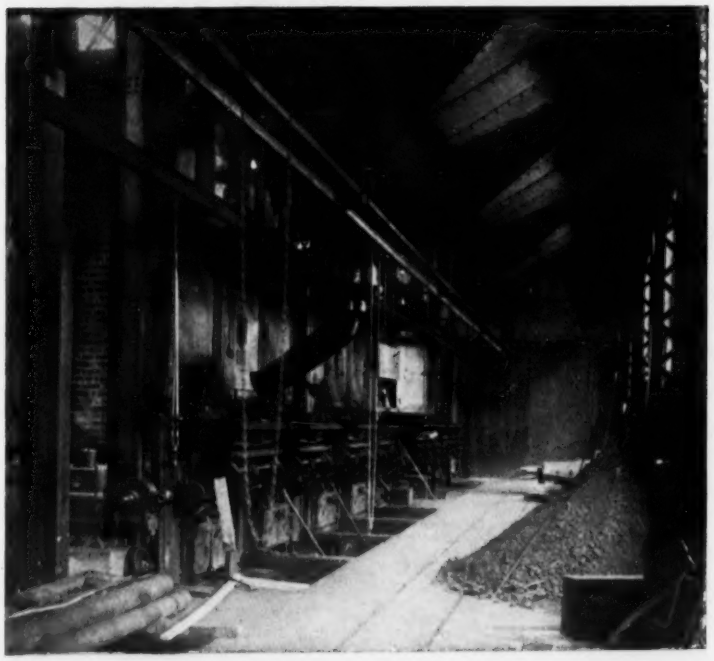


FIG. 2.—BOILER ROOM, SHOWING TRAVELING AND WEIGHING COAL HOPPER.

by gravity to the dumping blocks, after which they are returned to the loading hopper by automatic mechanism. The loaded car automatically grips a cable line near the dumping point and a gearing serves to lift a heavy counterweight by means of the momentum of the loaded car. After the car trips and the coal is released, the energy stored in this lifted counterweight serves to kick the car up the incline to the tower. The dumping block is adjustable upon any of the trestles, so that coal may be delivered at any point in the yard. The coal-hoisting tower is fitted with a one-ton clam-shell dredging bucket and has a capacity of 50 tons per hour. The boom has a maximum reach beyond the wharf line of 19 ft. and is 54 ft. above mean water level. It is pivoted so as to permit it to be swung to one side and allow masted vessels to tie to the dock. The operating machinery in the cabin consists of an Exerter double steam

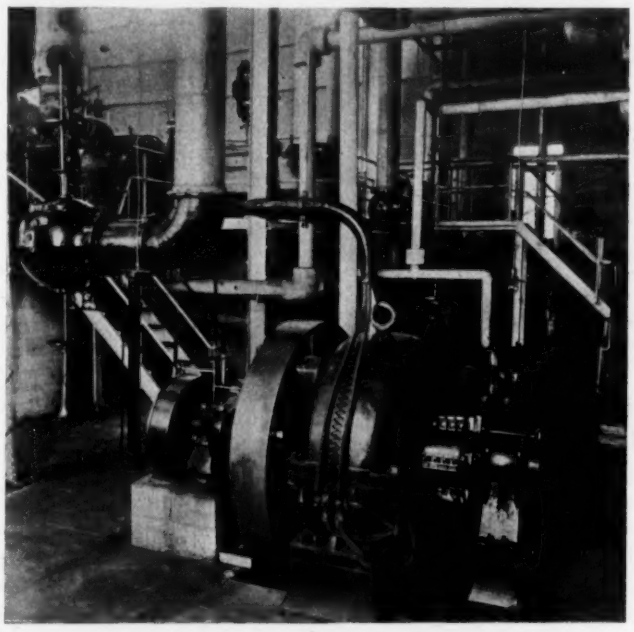


FIG. 3.—STEAM-DRIVEN EXCITER AND PUMPS.

hoisting engine with drums for the hoisting and bucket-closing movements and a motor-driven crusher. In the roof of the cabin is a five-ton receiving hopper into which the clam-shell bucket empties when unloading from boats. The coal passes from this hopper through a crusher operated by a 15-hp induction motor, into a small loading hopper beneath and thence into the cars. A turntable enables the cars to run on any trestle.

Coal is handled from the storage pile to the elevated bunkers in the boiler house by means of a system of scraper conveyors in tunnels beneath the storage platform, an elevator bucket conveyor and a scraper distributing conveyor extending longitudinally through the boiler house for delivering to the various storage bunkers. Beneath each trestle is an arched concrete tunnel extending inshore from the wharf 210 ft. and emptying into a transverse tunnel, where a cross gathering conveyor delivers the coal received from the longitudinal conveyors to an elevating bucket conveyor for delivery to the boiler house. The conveyors are operated by a 15-hp induction motor which drives the scrapers at a speed of 90 ft. per minute at which speed the conveyor system has a capacity of 50 tons of coal per hour. Outlet hoppers are provided about every 12 ft. in the longitudinal tunnels beneath which are receiving hoppers with delivery spouts and aprons to direct the coal into the conveyor trough. From the cross tunnel the coal is elevated by a bucket conveyor to a height of 35 ft. above the storage platform level where it is dumped into the conveyor in the boiler house monitor. There is also a direct chute connection with the elevating conveyor which permits of coal being delivered direct from the cars when a boat is unloading thus dispensing with any rehandling.

The distributing conveyor in the boiler house monitor is similar in design and capacity to those in the tunnels beneath the storage platform, and is operated by a 10-hp induction motor located within the boiler house. This conveyor is carried from the delivery spout of the elevating conveyor to the boiler house monitor by a wooden supporting structure inclined at an angle of 15°. Within the boiler house the conveyor is carried in the framework of the monitor and the scraper trough has dumping outlets at frequent intervals with chutes to permit the delivery of coal into any of the bunkers over the fire room floor. These bunkers are 15 ft. square at the top and 8 ft. deep and have a capacity of

15 tons. A traveling weighing hopper delivers the coal from the bunkers to the stokers in measured lots of 1,000 lb. or less. This device is shown in Fig. 2. It consists of a cylindrical receiving hopper 28 in. in diameter and 3 ft. high, which with its weighing mechanism travels on a runway of 8-in. channels beneath the undercut gates of the bunkers, thus permitting coal to be taken and measured from any bunker and delivered into any of the stokers. The scale mechanism is suspended from a car framework, beneath which is suspended the swinging compensating links and reducing levers for the scale upon which the hopper is supported. The car and hopper are caused to move along the runway by a chain wheel mounted on one of the axles of the car, the chain being within easy reach from the floor. The outlet gates beneath the bunkers are provided with chain connections for ease in opening and closing from the floor in measuring out quantities of coal. The delivery chute beneath the hopper is suspended by a ball bearing joint which permits it to be swiveled from one side to the other when traveling along the runway. The entire coal-handling equipment, including the unloading tower, trestle lines and automatic car operating system, tunnels and scraper conveyors, etc., was built by the Exeter Machine Works, Pittston, Pa., after the designs of the consulting engineer, Mr. C. O. Mailloux.

The present boiler equipment consists of four horizontal water-tube boilers built by the Aultman & Taylor Machinery Company, two being of 425 hp and the other two having a capacity of 500 hp each. The boilers are installed in two batteries and are equipped with Foster superheaters capable of raising the temperature of all steam delivered at the rated capacity of the boilers, 150° F. above saturation. The boilers have delivery nozzles for both saturated and superheated steam, which is delivered to the turbine room by a duplicate piping system, one for the superheated supply to the turbines and the other for supplying saturated steam to the auxiliaries. Each boiler is equipped with a Roney stoker operated by standard Westinghouse stoker engines, two of which are installed with coupling connections between the sections of the driving shaft so that either may operate both stokers together, or either battery separately.

Ashes are removed through a tunnel beneath the furnace ash-pits, cars running upon the narrow-gauge track permitting the ashes to be dumped directly into them. Each furnace is fitted with a fire brick lined ash-pit, in the lower outlet of which are trap doors. These doors are normally held up in place by sector blocks upon a rocker shaft beneath. The hand wheel upon this shaft is fitted with a connecting rod and lever by which it is possible to dump first one door and then the other without discomfort to the operator. The trap doors are of ½-in. steel plate lined upon the inner side with cast iron for protection from the heat of the ashes. There is also a soot chute connecting from within the boiler setting to this ash-pit, by means of which soot can be shoveled out without bringing it into the boiler room. The ash cars are elevated to the surface for dumping by means of a plunger elevator. The smoke flue connections to the stack are beneath the boiler room floor in a space at the rear of the boiler settings. Each boiler has a flue connection extending from the rear of the setting and connecting with the main flue, which is of substantial fire brick construction.

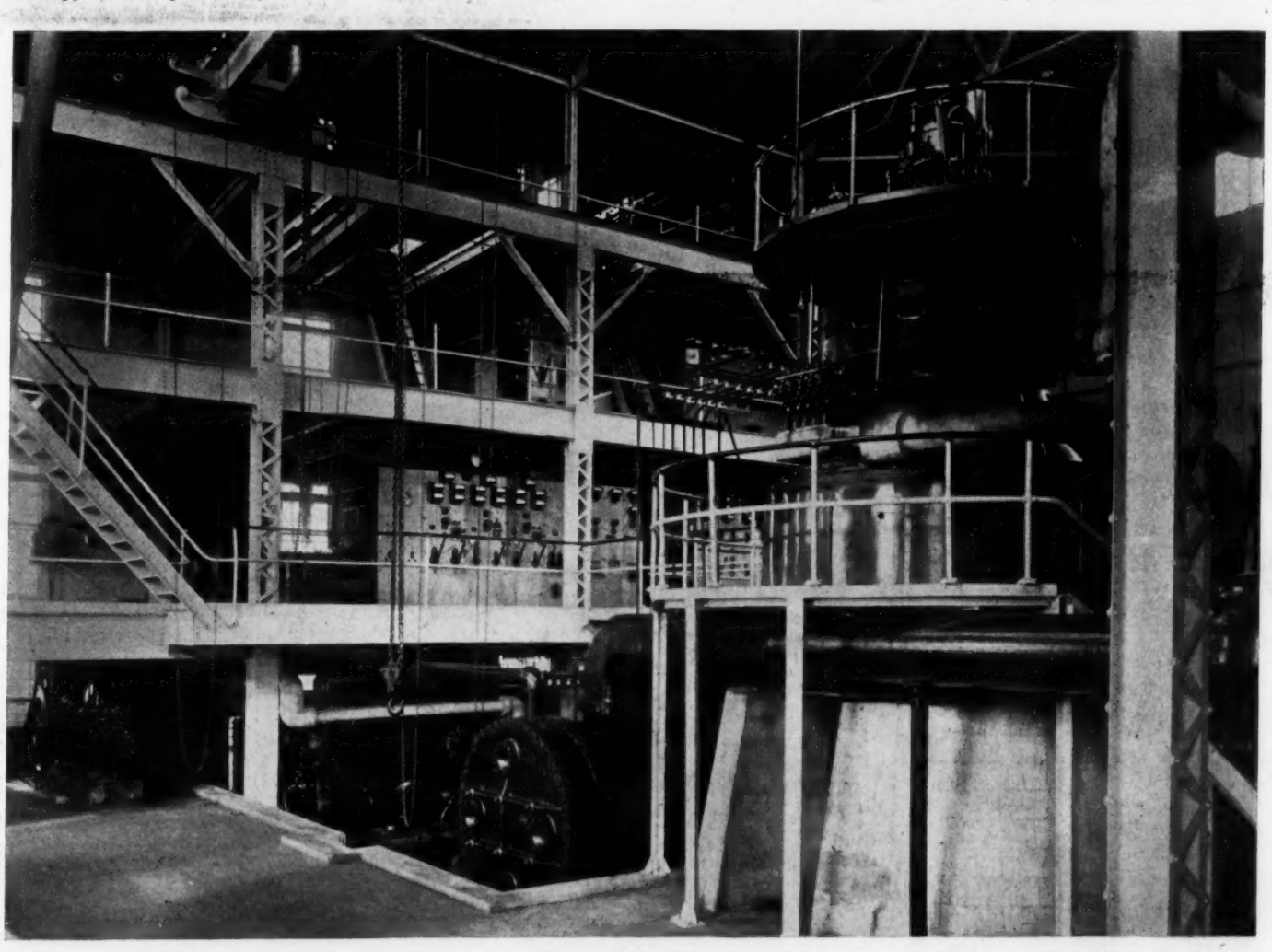


Fig. 4.—General View of the Interior of the Nassau Light and Power Company's Station at Glenwood, L. I.

Two 5,000-hp closed feed-water heaters located in the side bay of the turbine room and fed with exhaust steam from the auxiliaries heat the boiler feed supply. The heaters are cross-connected so as to permit either one to be operated independently for facilitating examination and repairs to the other. Feed pumps are also installed in duplicate, either one being capable of supplying the boiler equipment. The water supply for the station is obtained through a pair of 3-in. driven wells at the rear of the boiler house adjacent to the stack. Water is pumped from

these wells by an electrically-driven triplex pump to a 50,000-gal. storage tank upon the hill opposite the power house. The water in the tank upon this hill being about 80 ft. above the level of the water service mains in the boiler room, a delivery pressure upwards of 40 lb. is available by gravity for fire protection and local service. The water is of excellent quality and is thus serviceable for the "make-up" to the condensation of the turbines for boiler feeding purposes. The main boiler feed supply is stored in two hot water cisterns in the boiler room. Each of these cisterns has a capacity of 2,000 gal. and receives the condensation from the condensers directly, the make-up being added automatically by a float valve on the water service connection to the cistern. Six-inch suction connections from the feed pumps are made in duplicate to the cisterns for either pump. These 6-in. lines enter the cisterns through stuffing box sleeves in the side of the cistern wall about 3 ft. beneath the normal water level.

The steam turbine generating equipment of the station as at present installed consists of two 400-kw Westinghouse turbo-generators and one 1,500-kw General Electric turbo-generator unit, space being provided for an additional 1,500-kw unit when future growth so demands. The turbines embody the well-known standard construction of the Parsons and Curtis types, as adapted for direct connection to revolving field, two-phase alternators, the Westinghouse units running at 3,600 r.p.m. and the General Electric unit at 900 r.p.m. Superheated steam is supplied to the turbines through 5-in. lines from the 12-in. main superheated steam header to the two small units and a 10-in. line to the 1,500-kw unit. Each of these superheated steam connections is, however, interconnected with the 8-in. saturated steam header in the boiler room for purposes of reserve supply, which in case of accident to the superheated line would enable the turbines to be operated temporarily with saturated steam. equipped with drip connections which are drained by return steam traps.

The turbines are operated with individual surface condenser equipments, which are located underneath the operating gallery and in close proximity to the exhaust connections. The two small turbines have 30-in. exhaust openings and 14-in. atmospheric exhaust lines fitted with back pressure valves. The Curtis tur-

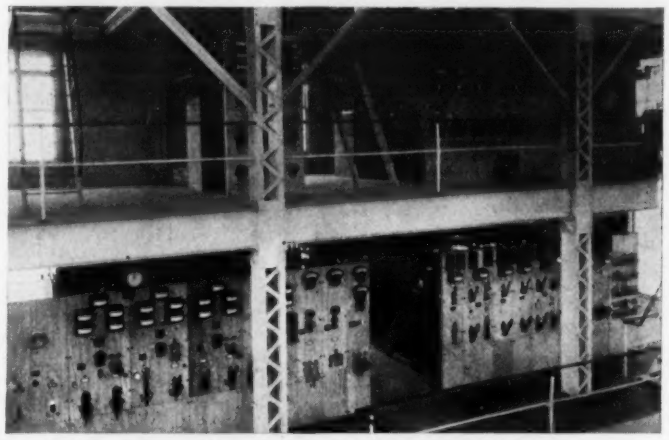


FIG. 6.—SWITCHBOARDS IN GLENWOOD POWER HOUSE.

bine has an exhaust connection of rectangular section with an 18-inch atmospheric exhaust line. The surface condensers used are all of the well-known Worthington counter-flow type with air coolers, condensation being removed by two-stage turbine centrifugal pumps. The condensers for the small turbines have a condensing surface of 2000 square feet, while that for the

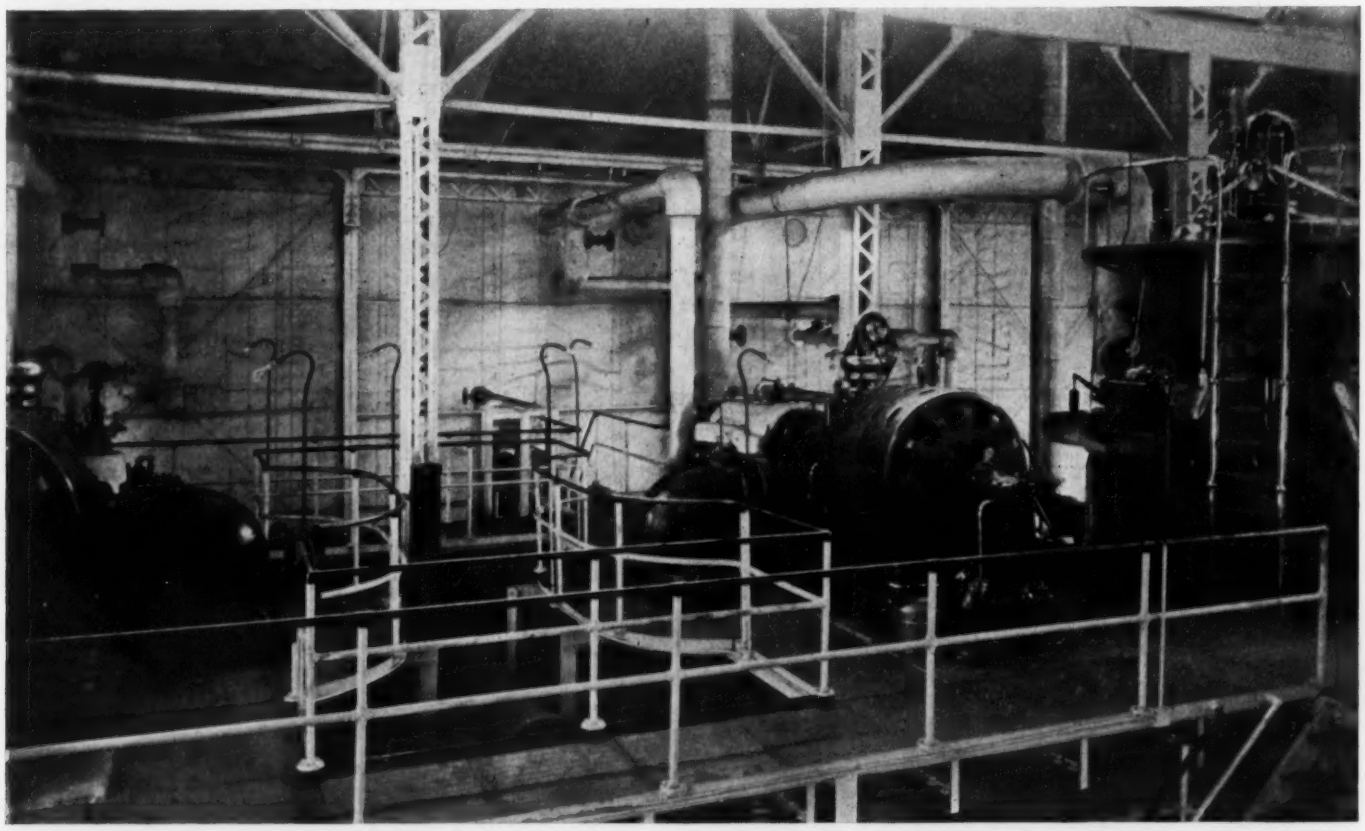


FIG. 5.—VIEW OF TURBO-GENERATOR SETS FROM SWITCHBOARD GALLERY.

The two steam headers are similarly interconnected in the boiler room so that the saturated header may be used for the supply of superheated steam temporarily if necessary. The superheated piping system was installed by Westinghouse, Church, Kerr & Co., while all other piping was erected by the Nassau Light & Power Company. All piping is well lagged and all branches are

1500 kw unit has a condensing surface of 6000 square feet. The centrifugal pumps for the condensers connected to the smaller turbines are each independently driven by a 5 hp induction motor, while the pump for the large condenser is operated by a 10-hp motor. Dry vacuum pumps are used in connection with these condensing units, that for the large condenser being

a 10 x 16 x 18-inch Worthington dry vacuum pump, while the two 400-kw turbines are served by a single 8 x 14 x 12-inch vacuum pump. Circulation water is supplied to the condensers by two No. 14 Worthington volute centrifugal pumps located beneath the switchboard gallery with direct suction connections

FIG. 7.—TRANSMISSION LINE.

to the intake water tunnel leading into the bay. Each of these pumps is driven by a vertical automatic steam engine and has 15-inch suction and delivery connections. The deliveries from the two pumps unite in a 20-inch header, from which the connections into the air coolers and their condensers are taken. The discharge connections consist of two 15-inch lines, one for the large condenser and the other for the two smaller units. Considerable reserve capacity has been provided in the intake and discharge tunnels, which were designed for eventually supplying a station with a rated capacity of 5300 kilowatts.

The electrical generating equipment at the station consists of two 400-kw Westinghouse turbo-generators and one 1500-kw General Electric turbo-generator each generating 60-cycle two-phase currents at a potential of 2200 volts. Duplicate exciter sets are installed consisting of a 35-kw motor-generator set on the main gallery and a 50-kw steam-driven generator shown in Fig. 3. The transformer equipment shown by Fig. 8, consists

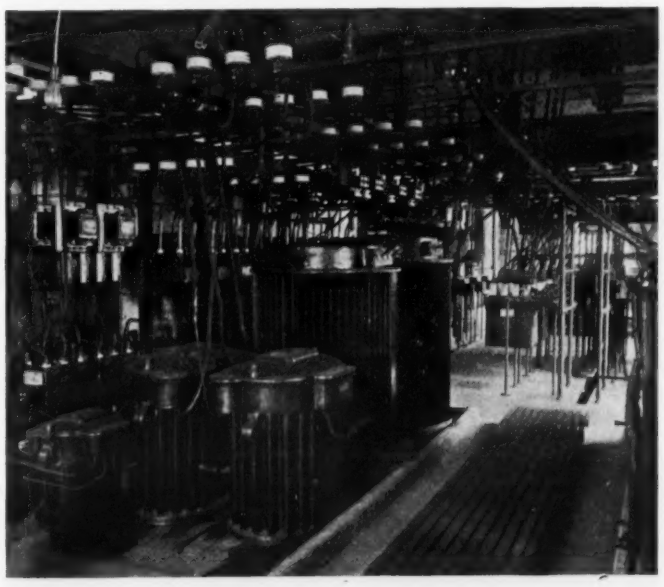


FIG. 8.—REAR VIEW OF SWITCHBOARDS, MAIN GALLERY.

of three 200-kw and three 100-kw American transformers which step up the primary potential of 2200 volts to 6600 volts for distribution. There are in addition four 17½-kw 3-ampere General Electric constant-current transformers for street lighting circuits.

Three galleries are provided for the controlling switchboards; on the first or main gallery are the generator, exciter and transformer panels; on the second or feeder gallery are the high and low tension feeder panels, while on the third gallery or tower are the lighting arresters, choke coils, etc., for the outgoing low-tension lines. A view of the main and feeder galleries is given in Fig. 6. There is a panel provided for each of the three turbine sets and one spare panel. Each is fitted with ammeters, wattmeters and voltmeters and with polyphase recording watt-hour meters on the rear of the panel. Each panel also contains synchronizing plugs and two interlocking oil switches, while on top of the generator switchboard is a General Electric synchronizer mounted on a swinging bracket. Forming part of the generator switchboard are two panels for the exciter units and one spare panel fitted with ammeters, voltmeters, balance indicators and knife switches, also one regulator panel fitted with a Tirrell regulator and one main transformer bus-bar panel fitted with interlocking switches for each bus-bar with time limit relays.

To the right of the generator switchboard on the main gallery are six transformer panels fitted with single-throw double-pole oil switches on both the low and high tension sides of the transformers and with ammeters on the primary circuits. To the right of these panels are two station panels fitted with knife switches for controlling the station light and motor circuits.

On the second gallery are four two-phase 2200-volt circuit panels fitted with double-pole double-throw switches, ammeters and General Electric spring-expulsion fuses. Pilot lights are located on each phase of each circuit. There are also four series incandescent street lighting panels of standard design fitted with ammeters. Separated from these panels and situated to the left are three high-tension feeder panels, one spare, having ammeters and oil switches with automatic relays. Choke coils and arresters are fitted to both the high and low-tension feeders in the tower, the arresters being of the low equivalent Westinghouse type.

The general switching arrangement is as follows: There are two sets of bus-bars permitting the generators, transformers or circuits to be connected to either set. The connection from the 1,500-kw unit to the switchboard is made with 500,000-cir.-mil rubber-insulated asbestos-covered cable tested for 10,000 volts. The cables from the 400-kw units are of No. 1 conductor insulated in the same manner as the other cables. The generator and transformer bus-bars are made up of copper bars 2 inches by 5/16 inch in cross-section. High-tension circuits are run from the Glenwood power house to sub-stations located at Oyster Bay, Roslyn and Hempstead; from which sub-stations the current is stepped down to 2200 volts for local distribution and street lighting circuits. In addition low tension feeders are run from Roslyn to sub-stations at Great Neck, Port Washington and Hicksville, where street lighting transformers, local circuit panels and regulators are located.

The company has recently secured control of the Oyster Bay Electric Light & Power Company, and it is its intention to use this company's station as a sub-station and abandon the present sub-station at Oyster Bay and in addition shut down the old steam plant consisting of 300-hp in high speed engines and two 200-kw single-phase alternators which run only at night, and maintain a day and night service. The high-tension transmission line is of No. 6 hard drawn copper wire, and the insulators are of triple-petticoat glass. It is the intention of the company to eventually operate the transmission lines at a potential of 10,000 volts and the switchboard galleries and tower have been laid out with this in view. All circuits feeding districts within a five-mile radius are supplied with energy at 2200-volts.

The plant was designed by C. O. Mailloux, the details and supervision being in charge of his assistant, W. H. Heath. Since the early part of last summer the station has been operated by J. G. White & Company, who are represented by K. B. Thornton, manager of the plant. The officers of the company are E. D. Morgan, president; C. H. Mackay, vice-president; C. I. Reeves, secretary and treasurer; John Sarano, superintendent and chief electrician, and J. W. Wood, chief engineer. We are indebted to Messrs. Heath, Thornton and Sarano for courtesies extended in the preparation of this article.

The Boston Edison Company's Work in Wellesley.

The Edison Electric Illuminating Company, of Boston, has recently made a contract to supply the town of Wellesley with electricity at a wholesale rate, and the details of the arrangement well illustrate the advantages which accrue to a suburban community which becomes a central station customer instead of attempting to realize the doubtful economies of a municipal plant. Wellesley is an attractive residential suburb of Boston located 15 miles west of the South Terminal station on the Boston and Albany Division of the New York Central lines. Its population is something in excess of 5,000, and it is the seat of Wellesley College, a girl's educational institution of international celebrity.

Originally the town purchased current for street and commercial lighting from the Natick Gas & Electric Light Company. Under the Natick contract the rate per kilowatt-hour for both residence and business lighting was 14 cents flat. In 1903 the Edison Co. took over the Natick Co.'s business, and, of course, continued to supply the town at the old rates. The town owned all the poles at this time. As the time of expiration of the Natick contract approached, the question of building a municipal plant came up. The Edison Company was asked if it would supply electricity at the town line on a flat rate of 3 or 4 cents. The company could not do this, but instead it made the town a proposition on the basis of a standard lighting contract, by which, on the basis of the last year's business, a net rate of 6 cents per kilowatt-hour at the town line was made possible. The town was to purchase all the wire, transformers, meters, etc., which belonged to the Edison Company upon its distributing system within the limits of the municipality. The proposition was accepted at the October, 1905, town meeting, and a seven-year contract signed. On January 1, 1906, the Edison property was taken over and the current for the town supplied from the adjacent Edison stations in Natick and Newton. In the very near future the current of Wellesley will all be supplied over a four-wire, three-phase line about two miles long, extending from the Edison distributing station at Walnut St. and Commonwealth Ave., Newton, to a distributing station to be built by the town of Wellesley near Wellesley Hills Square. The current will be generated at the great L Street station of the Edison Company in South Boston, whence it is to be transmitted to Newton over a line operated at 6,600 volts and about 10 miles long.

The Edison meters are to be installed in the distributing station at Wellesley Hills Square, and the drop in voltage between the town line and this station is not to exceed 1 per cent. The street lighting in Wellesley is furnished by 25-cp series incandescent lamps, the equivalent 16-cp street lighting connected load being 1,043 lamps. The commercial and residential lighting loads amount to 8,251 equivalent 16-cp lamps.

Under the terms of the new contract all bills are rendered monthly to the town on the basis of 1 cent per 16-cp lamp hour consumed, until the consumption for the month exceeds 2,964 times the number of hours shown in the following table, this product constituting the minimum at which bills are rendered during each month:

January, 50 hrs.; February, 40 hrs.; March, 30 hrs.; April, 30 hrs.; May, 20 hrs.; June, 20 hrs.; July, 20 hrs.; August, 20 hrs.; September, 30 hrs.; October, 40 hrs.; November, 50 hrs.; December, 50 hrs.; total, 400 hrs.

The 2,964 lamps mentioned above represent the estimated maximum number of lamps lighted at any one time, and this figure is to be used as the basis of the primary lamp hour charge until the installation of a demand meter by the Edison Company. The maximum reading of the demand indicator between November 1 and the following February 1 of each year plus the load as estimated by the company on any circuits not connected to the indicator, will be substituted for the above figure, 2,964. If the town pays its monthly bill within 10 days after presentation, the rate of charge for all electricity consumed in excess of the above minimum is to be .4 cent per lamp hour. Otherwise, the charge remains at 1 cent. In case the gross lamp hours consumed in any one month exceed 10,000, the secondary lamp hours for that month are to be billed at .25 cent. Whenever the bill figured at the primary rate of 1 cent per lamp hour and secondary rate of .25 cent per lamp hour is over $150 in any one month, then 40 per cent discount is allowed on the excess of the bill up to $550, and 50 per cent discount in excess of $550.

In case the yearly cost does not exceed 6 cents per kilowatt-hour in the average, the difference of 8 cents per kilowatt-hour between the old 15 cent price and the new one can be applied either to the reduction in the cost of street lighting, or, if it seemed best, after maintenance and operating expenses are paid within the town, it is possible that some reduction might be made to the individual consumer. The price depends entirely upon the maximum demand and the actual current consumption as indicated by meter. In the two months of 1906 in which the new plan has been in operation the cost of current per kilowatt-hour to the town has actually been less than 6 cents. The January consumption, 28,000 kilowatt-hours, was billed at $1,233, or 4.43 cents per kilowatt-hour delivered at the town line; the February load gave an output at the town line of 24,000 kilowatt-hours, costing 4.3 cents per unit delivered. These prices are, of course, low, partly on account of the winter season with its long hours of darkness, and it is very probable that the lower consumption of current in the spring and summer months will be billed at higher rates. What the average for the year 1906 will be cannot be foretold, but there is good reason to expect it will not be much in excess of 6 cents. The arrangement with the Edison Company saves the town a heavy investment in generating plant and does away with the trouble of operating a central station upon the town's responsibility; it enables the service to be extended with the greatest facility; opens the way to a possible reduction of current over old bills; and places the reliability of an Edison station at the service of even the smallest consumer. Not the least advantage is elimination of the haulage of large quantities of coal through the beautiful residence streets of the town, and the doing away with a smoke nuisance in the neighborhood. Plans for the securing of new business are not fully organized as yet, but the town holds the entire matter in its hands and has every advantage claimed by the advocates of municipal ownership in reference to dealings with private consumers and control of the service within the community. The Edison Company's experience in methods of getting new business has been placed at the town's disposal.

The service in the town is under the supervision of the Board of Water and Municipal Light Commissioners. The chairman of this board is Mr. F. L. Fuller, the other members being Mr. O. L. Schofield, and Prof. C. E. Fuller, of the Massachusetts Institute of Technology, secretary. Mr. G. G. S. Perkins is the manager of the electric light service, and Mr. F. O. Johnson is the treasurer.

Unbroken lamps are renewed free of charge for installation and renewal, and all current is sold to consumers by meter at the flat rate of 14 cents per kilowatt-hour with a minimum charge of $1 per month. The standard voltages of the commercial system are 110 and 220, and the frequency of the entire alternating current system is 60 cycles. When overhead wiring is used, no charge is made for the installation of service, provided the point of entering is not over 100 ft. from the street line. Where underground service is used the town will install the service 5 ft. beyond the street line without charge. The town does not install or become responsible for inside wiring. Lamps are furnished consumers in 8, 16, 32 and 50-cp sizes, plain frosted bulbs. On special application 100-cp lamps in clear glass and 50-cp Meridian lamps are furnished free for renewals, but not for installations. Alternating current motors wound for 110 volts are allowed to be installed by the consumer, but anything in excess of 2 hp requires a special agreement with the Commission. Very few motors are thus far in use in Wellesley. Current for domestic service is furnished continuously 24 hours per day.

Differential Central Station Rates.

The report submitted March 16 to the Chicago City Council by Mr. Bion J. Arnold and Mr. William Carroll, Chicago city electrician, on the question of the reduction of Chicago electric lighting rates is of much interest aside from the main purpose of the report, on account of the discussion contained on the general subject of equitable central station rates. The main purpose of the report was to give the results of an investigation into the business of the Chicago Edison and Commonwealth Electric Companies to assist the Council in the consideration of a proposed reduction of rates charged by these companies.

The report is divided into two parts, in one of which is considered the question of a reasonable maximum demand on the assumption that the companies cannot be compelled to accept less than cost; the second part taking up the question of a reasonable rate on the assumption that the companies can be required to serve a portion of their customers at less than cost, provided the returns on the total lighting business are reasonably profitable. In the preliminary portion of the report it is brought out that there is very little complaint as to the quality of service which the Chicago companies are rendering. These companies employ the highest grade of engineering skill, the most improved equipment and the latest advances in the art of generation and distribution, the result being an electric lighting system which is to be commended for the reliability and quality of its service. While the use of large modern generators in great central power stations is decreasing the cost of producing electrical energy, this is off-set to a certain extent through transmitting the energy to longer distances and distributing it over wider territories.

The report states that when the electric lighting business was new there was a general adoption of a maximum rate of twenty cents per kilowatt-hour. This rate has been gradually reduced in different cities, the most notable example being the recent action of the city of New York, where the maximum rate has been put at ten cents per kilowatt-hour in the borough of Manhattan, a congested district, and at twelve cents per kilowatt-hour in the borough of Brooklyn, where the distance of transmission is greater and the business more widely scattered.

In Chicago the use of the Wright demand system of metering and charging for electric lighting furnished by the Edison and Commonwealth Companies is almost universal. With this system two meters are connected for each customer, one (the watt meter) to show the kilowatt-hours of electrical energy actually supplied during any month or other period, and the other (the maximum meter) to show the greatest demand made at any one time. Both meters are read monthly. The charge for current is made at the rate of twenty cents per kilowatt-hour for that amount of energy equal to a thirty hours' use of the capacity indicated by the maximum-demand meter, and at the rate of ten cents per kilowatt-hour for all current in excess of this amount. The maximum charge is subject to a discount of 20 per cent. for the prompt payment of the bill, and the low rate charge is subject to varying discounts according to quantity used. No minimum is charged. The original installation of lamps and lamp renewals are furnished free.

The intention of this system of charging is to make *good* customers of all users—that is, as far as possible, to make each customer pay not only for the cost of actually producing his current, but also to stand his equitable share of the fixed charges upon the investment which is has been necessary to make in order to get ready to serve him. The demand meter differentiates between "short-hour" users and "long-hour" users, and gives the benefit of the lower or secondary rates to a customer only after he has paid for sufficient current at the maximum rate to reimburse the company for the use of its capacity as indicated by the maximum meter.

The necessity of some such system of charging arises from the fact that electric companies must manufacture the most of their product only as required, and, therefore, cannot in fairness to themselves, or to the community, charge a flat rate similar to that of the gas companies who can manufacture gas at a uniform rate and store it in gasometers. Storage batteries are used by electric companies to accomplish a similar object, but the cost of batteries prohibits their use for any considerable amount of the load. There are a number of systems of charging in use in different cities, all of which have been adopted with the idea of dividing the charge for current into two parts, one varying with the fixed expenses on the entire system, and the other varying with the output of the generating plant. The system now in use in Chicago was adopted after a careful investigation and has been thoroughly introduced so that at present over 95 per cent. of the lighting customers of the two companies are served through the double meters.

It should be pointed out, however, that the movement to reduce the maximum rate and the system of charging provided by the Wright maximum meter are diametrically opposed. To reduce the maximum would ordinarily mean to equalize the schedule of rates, that is, if the maximum is reduced and the income remains the same, then the minimum must be correspondingly increased, the movement being toward a flat or uniform rate, and this is exactly what the advocates of the Wright demand system are trying to get away from.

The working out of the Wright demand system to its logical conclusion would mean that each customer would stand on his own feet and pay for the actual and equitable cost of his service plus a profit, and if this could be done the supply companies would be doing no part of their business at a loss; but this cannot be accomplished if a limit is put on the maximum charge.

On the other hand, if the maximum charge is reduced, the lighting companies will be forced to do a certain amount of their business at a loss, that is, the "short-hour" consumers—who are the ones most affected by the maximum rate—will be getting their current at less than actual cost, and the loss must be made up by a reduction in income or by making higher than would otherwise be necessary the rate to the "long-hour" consumer.

Theoretically each customer should pay for his own service, and as the Wright demand system aims to accomplish this result, it is theoretically a step in the right direction. On the same theory, however, every merchant should charge proportionately more for the delivery of small purchases than for larger ones—that is, if a pound of coffee or a yard of silk is delivered by itself a higher charge per pound or yard should be made than would be the case if this small purchase were to be delivered with a larger bill of goods. This policy would not be considered good business. As other merchants consider it to their interest to do a certain amount of their small business at a loss it is not surprising to find that public sentiment is in favor of reducing the maximum rate for lighting, even if the supply company must make up this loss by a slightly larger charge than would otherwise be made upon their larger sales.

The problem, therefore, resolves itself into the establishing of a fair balance. The desire of the lighting companies is to make each customer pay his own bills, and, therefore, they wish to maintain a schedule with a high maximum and a low minimum. The sentiment of the public is apparently to reduce the maximum so as to give the greatest number of customers the benefit of a comparatively lower rate, even if this benefit is to be secured at a loss to the companies, or at the expense of the wholesale customers. The question, therefore, involves the rights of the "short-hour" customer, of the "long-hour" customer, of the wholesale customer, and of the producer, and should not be settled entirely in favor of any one and at the expense of the others.

Taking up the question of a reasonable maximum rate on the assumption that the companies cannot be compelled to accept less than cost, two ways to alter the present maximum rate are mentioned:

a. By changing the maximum part of the rate to 15c, to 14c, to 13c, to 12c, to 11c, or to 10c, as may be agreed, leaving the secondary part of the rate at its present amount, viz., 10c. The reduction of the maximum rate in this way to 10c without

changing the secondary rate would thus ultimately result in a "flat" rate which would treat all customers alike irrespective of the amount or character of their demands.

b. By changing the *time* during which the demand registered by the maximum meter must be used before the customer gets the benefit of the secondary or lower rate. At present this maximum demand (in kilowatts) is multiplied by 30 (hours) to get the kilowatt-hours which must be used at the maximum rate before the secondary rate is applied. This 30 hours might be reduced to 20 hours, to 15 hours, or to 10 hours, and the result would be to reduce the customer's bill. It should be borne in mind that the maximum demand meter does not indicate the length of time during which this greatest demand continues. Whether or not this system works an injustice depends upon the character of the customer's load. For instance, in the case of a flat owner using his maximum number of lights for only two or three evenings in a month the practice of charging for 30 hours' use of this maximum capacity would be wrong, but to a restaurant keeper using his maximum capacity for four or five hours a day, or 150 hours per month instead of thirty, the practice of using the constant 30 is not unfavorable to the user.

There can be no doubt that with the maximum rate as at present that some customers are served at a loss. In fact, figures have been compiled by the companies showing that a large percentage of their customers are supplied at present at less than cost. In spite of this fact, however, the companies have evidently thought it best to reduce their maximum rates, which indicates their willingness to do a certain amount of business at a loss. If this is "reasonable," how far can it be carried?

No attempt was made in the investigation to discuss at length the minute details of the method used by the companies in figuring their costs to their smaller customers. A very cursory examination of the subject will lead to the conclusion at once that some of the business is carried on at a loss, and that quite a number (perhaps 25 per cent) of the customers are not producing a profit. A reduction in the maximum rate will naturally increase the number of customers in this class, which number is claimed by the companies to be at the present time over 10,000.

Although the *number of customers* getting served at a loss may appear large, the *total amount of actual loss* to the companies when measured in dollars compared to the total income from all lighting customers is small, for it is only those using a small amount of current that are supplied at a loss.

It is only by arbitrarily reducing the maximum rate in one of the ways indicated above that the "short hour" customers will get the benefit of advances made in the art. For instance, the actual cost for fuel used in producing the electric current of the companies under discussion is such a small proportion of the total cost of supplying a small or "short-hour" customer that if some method were discovered whereby the cost of fuel could be entirely eliminated, the investment remaining the same as at present, the reduction in the maximum rate, if the entire benefit were to be given to the customers, would only amount to ½ cent per kilowatt-hour. To a customer paying the 16-cent rate this reduction would not be material, while to a wholesale customer getting energy say at 4 cents per kilowatt-hour, a reduction of ½ cent per unit would produce a considerable saving.

Improvements are being made in the art of generating and distributing electrical energy which are gradually decreasing the cost. The volume of the electric lighting business in Chicago is increasing rapidly, and this increase is gradually decreasing the cost of each unit of current distributed. The larger sizes of the generating units now available make the cost of getting ready to serve each customer less each year. The use of batteries to insure reliability of service and the extension of the circuits into larger and more sparsely settled territory are offsets, however, to the general tendency toward a reduction in cost.

If the contention is made and maintained that the companies are not to be expected to do any business whatever at a loss then the present maximum rate cannot be reduced. If the question is how much of their business they can be expected to do at a loss, then the answer can only be scientifically determined by going more deeply into their affairs than has been done thus far in this discussion. It is only by taking a broad view of the entire business that a conclusion can be arrived at as to whether the maximum rates can be reasonably reduced.

The report then takes up the discussion of a reasonable rate on the assumption that the companies can be required to serve a portion of their customers at less than cost, provided the returns on the total lighting business are reasonably profitable.

There are a large number of combinations of the maximum and minimum rates which can be made. The companies, it seems, are willing to agree, under certain named conditions, to reduce their present rates of 16 cents and 10 cents to a maximum of 14 cents and a secondary of 9 cents for the next two years, with a further reduction to 12 cents for the maximum rate and 8 cents for the secondary for the last three years of the next five year period.

In order to show the relative influence of these suggested rates upon the income of the companies as compared with other rates, including a flat rate of 10 cents per kilowatt-hour, the following table has been compiled:

Possible Changes in Rates in Cents per Kilowatt-Hour.	Total Income at Various Rates	Percentage Total Income at Various Rates.
20 and 10	100.0%	None
16 and 10	92.8	7.2%
16 and 10—with 10 hrs. time limit. 14 and 10	89.2	10.8
14 and 9—suggested by companies for 2 years 12 and 10—	85.8	14.2
14 and 8 12 and 9 10 and 10 flat rate	82.3	17.7
14 and 7 12 and 8—Suggested by companies for last 3 years	78.8	21.2
12 and 6	71.6	28.4

The above table shows that:

a. The reduction in rates already in force and made voluntarily by the companies amounted to a reduction in their gross income from lighting of 7.2 per cent. This does not include the loss sustained by waiving their minimum charge, which was done at the same time.

b. The reduction of rates for the first two years to 14 cents and 9 cents, as suggested by the companies, means a further reduction of 7 per cent. from their original income, or a total reduction of 14.2 per cent.

c. The reduction to 12 cents and 8 cents as suggested by the companies, means a further reduction amounting to a total of 21.2 per cent of their income.

d. This last rate of 12 cents and 8 cents is actually less than a flat rate of 10 cents per kilowatt-hour, on account of the fact that the amount sold at the secondary rate averages twice the amount sold at the primary rate, so that under these conditions a rate of 12 cents and 8 cents is the same as an average flat rate of 9⅓ cents.

e. A reduction of rates to 12 cents and 6 cents would mean a 28.4 per cent decrease in an income based on a rate of 20 and 10.

f. Either of the combinations of rates (14 and 8) or (12 and 9) are an exact average of the two sets of rates proposed, that is (14 and 9) and (12 and 8).

To determine whether or not it would be reasonable to ask the companies to do more at this time than they have indicated their willingness to do, a careful study and analysis has been made of the figures submitted, with the following results:

a. The full valuation of the properties and franchises as fixed by the Board of Equalization for taxation purposes is $25,707,000.

b. To make an inventory in order to get at the exact physical value of the properties, or to make an estimate of a replacement value would take more time than has been allowed for this investigation.

c. The sum total of the outstanding bonds and stocks does not exceed the published investment upon which interest and dividends are paid. That is, dividends are not paid upon stock which represents the value of the franchise. No bonds or stock have been recalled, however, to take care of depreciation.

d. Interest at the rate of 5 per cent. is paid on the bond issue and dividends at the rate of 8 per cent annually are paid on and stock issued. The average annual charge for interest and dividends is 6.5 per cent on the total par value of the bonds and stock.

e. The surplus earnings over and above interest charges are allowed to remain in the property to overcome the depreciation. The accumulated surplus and depreciation account amounts to about one-half of a theoretical depreciation account calculated on a basis of 6 per cent per annum. In other words, it appears from the figures submitted that the companies have not been earning sufficient surplus to equal an annual average depreciation of 6 per cent. (Land is not included in the depreciation calculation.)

f. The lighting load is increasing at about the rate of 7,500,000 kilowatt-hours each year.

g. The operating costs are decreasing gradually as improvements are made and economies are introduced, but the income per kilowatt-hour has decreased in about the same proportion, which means that the large users and not the companies have been getting the larger proportion of the benefit of the increased economies due to the improvements.

h. The investment per kilowatt of connected load is now only about one-half as much as it was five years ago and it is mainly on account of this decrease in investment per unit of capacity that the price per unit of energy sold may be expected to decrease.

i. The percentage of current sold compared to the amount generated is decreasing instead of increasing. This is due to an increase in transmission and sub-station losses incidental to serving a larger territory.

j. The ratio of net earnings to gross earnings of the Chicago companies is slightly less than the average of a number of lighting companies in other large cities.

After a very careful study of the situation the report sets forth the conclusion that the Edison and Commonwealth Companies can afford to reduce their lighting rates.

If there is no desire on the part of the city to embarass these companies in their efforts to extend their lines and to render efficient and reliable service then their offer to reduce their rates to 14 cents for the maximum rate, and 9 cents for the secondary rate, for two years from the present time, and to 12 and 8 cents for the next following three years, may be considered reasonable and fair.

A thorough investigation of the affairs of the companies might show that these companies could afford to reduce their rates to 10 cents and 5 cents (equivalent to a flat rate of 6⅔ cents), but from all figures which have been submitted this rate, at the present time would be a hardship and would probably seriously embarrass the companies, but it is reasonable to expect that the companies can afford to and probably will eventually reach this latter rate.

Central Station Notes from Watertown, Wis.

The Watertown Gas & Electric Company operates two power plants; one, hydraulic, on the Rock River about a mile from the center of town, and the other a steam plant down-town. The latter is operated only during the evening. The company has been pushing the gas end of its business more actively of late than the electric, as the electric plants are loaded to their capacity and the gas plant is not. The capacity of the electric plant will be enlarged, soon after which a more active campaign for business will be begun. The connected lighting load is now about 3,500 alternating-current incandescent lamps and 25 commercial arcs.

The company has followed the example of a number of other towns in southern Wisconsin and adopted the Doherty readiness-to-serve system of charging, for those who desire it. The readiness-to-serve charge is 15 cents per month per 16-cp lamp after which the customer pays 6¼ cents per kw-hour for energy used. The other system of charging is a minimum bill of $1 and 12½ cents per kw-hour for energy used. The Doherty rate in Watertown, contrary to the experience in other neighboring towns, has not proved very popular among the merchants. Saloons are about the only class of customers taking advantage of it. Stores close at 6 p.m., except two nights per week, and for them the bills will be about the same whether they adopt the Doherty rate or the 12½ cents per kw-hour. If the merchants did show window lighting or display lighting during the evening after closing, the Doherty rate would be an advantage to them, and this is probably the reason for its popularity in neighboring towns where storekeepers have taken advantage of it to do display lighting.

The company furnishes free renewals of lamps of 2, 4, 8, 16 and 32-cp of the regular shaped clear bulb types. Special lamps are furnished at the difference in cost between them and the standard lamp of the same candle-power.

Central Station Questions Before the Association of Electric Lighting Engineers of New England.

At the fourth annual meeting of the Association of Electric Lighting Engineers of New England, held in Boston, March 21, five papers were presented treating of central station topics, abstracts of which are given below:

PROTECTION FROM HIGH VOLTAGES.

Mr. G. E. Palmer, of the Pettingell-Andrews Company, Boston, presented a paper entitled "Line and Station Protection Against High Potentials." Mr. Palmer began by pointing out that almost any line can be protected against high potentials if sufficient insulation and enough protective devices are installed, but stated that it was after all more feasible to try to protect the weak spots in a system than to attempt to insulate or protect it all on the same scale of investment. The majority of so-called static breakdowns in cables are due to defects which follow short-circuiting. The lightning arrester is merely a weak point in the system purposely made weak, and it should in all cases permit line discharges to continue without going out of service or without permitting arcs to form. Zinc, antimony, cadmium, bismuth and mercury are ideal metals for use as electrodes in lightning arresters, for their vapor does not perceptibly decrease the resistance of the gap. The ideal construction should allow equal opportunities at all points for the discharge of high potentials.

A very significant phenomenon was noted in a telephone circuit which Mr. Palmer installed in the Middle West. The circuit was about 100 miles long and the work in hand was the rebuilding of an old line. It was found that when new clean insulators were used, the line was very noisy and almost too poor for service. The insulators of the old line were put back, dirty from their former service, and the line at once became one of the best in the whole exchange. The distributed leakage took care of the static discharges without the least trouble.

Mr. Palmer suggested the construction of a special insulator which would offer a high resistance path to earth, constituting a "crack" in the electrical system. The idea would be to dip the insulator into a metallic solution before glazing it, mounting it in service upon iron pins with a common metallic ground connection. The metallic film would not act as a conductor in the ordinary sense for its resistance might be as high as 50,000 ohms, but it would be able to dissipate abnormal static discharges without punctures. It is not now considered good practice to protect series arc circuits with arresters designed to protect the system against the potential due to open circuits.

Mr. Palmer concluded by describing his device to prevent the abnormal use in potential on a constant-current arc circuit as the

tub transforming coils come together on open circuit. To prevent opening the other circuit or circuits of the transformer in case any one transformer circuit opens, an additional lightning arrester and impedance coil are placed across each circuit, so that the discharge potential passes through the impedance coil, operates a solenoid plunger and short-circuiting trip which dead short-circuits the line affected and leaves the balance of the lights burning steadily.

In the discussion which followed, Mr. G. R. Stetson, of New Bedford, mentioned a number of insulation punctures in customers' motors, which had recently occurred on his system, and stated that the trouble was finally eliminated by installing arresters and kicking coils at each important motor. With a fluctuating load this seems to be the safest course. Several other managers stated that it had been found necessary to isolate the transformers supplying wireless telegraph stations with power, and to discontinue the ordinary ground wire.

THE MAXIMUM DEMAND SYSTEM.

The next paper was by Mr. J. S. Codman, of Boston, the subject being "Discrimination in Rates." Mr. Codman began by pointing out the prevalent opinion on the part of the public that any other change for electric current than a uniform meter rate of so much per kw-hour is discrimination. Sometimes central station men subscribe to this idea, and it is high time that the public should be made to appreciate that systems in which the rates to different customers vary are not necessarily discriminating, but on the contrary, if they are properly devised, they approach ideal conditions of equity far more than a flat meter rate. A private company cannot be fairly charged with discrimination if it adopts a system of rates proportional to the cost of supply, and as a matter of fact private companies in this country have gone much further in this direction than have municipalities, while just the reverse ought to be the case, and no better example of the progressiveness of the private company could well be cited.

It will not do to establish a rate for the majority of the customers and then make special discounts to individuals, even if it does cost less to supply those individuals. Instead a schedule of rates should automatically make the rate proportional to the cost; it should be published and open to general inspection, and above all, the public should be made to understand that the rates will be adhered to under all circumstances.

Of all the systems, the flat meter rate is the worst as regards discrimination, since under it the charge is farther than with any other system from being proportional to cost, for the reason that the expenses proportional to the electricity produced from a small part of the total expenses, including interest and depreciation. Ordinarily the expenses proportional to output are not more than 15 or 20 per cent of the whole. An increase in current consumption of, say, 10 per cent, will only increase the total expenses to the company about 2 per cent, which means that the profit of the company at the given rate is liable to become exorbitant. If the consumption decreases 10 per cent the decrease in expense to the company will only be about 2 per cent, which may unduly reduce or wipe out the entire profit.

From 50 to 60 per cent of the expenses of a station are proportional to the maximum load which the station is called to carry, for it is this which determines the size of equipment. The interest, depreciation, taxes and insurance on this portion of the investment are proportional to the maximum demand, as are also part of the station wages, repairs and a small fraction of the coal, water and waste. Hence a charge based on the maximum demand will be more nearly proportional to the cost of supplying current than a charge based on the consumption. This is roughly the basis of the old contract system where a charge is made for each lamp on its equivalent in other apparatus. This had the great disadvantage of having no tendency to economize in the use of current, since there is no consumption charge. The contract system is well fitted, if based on the actual maximum demand, to smaller water power plants where moderate waste of current is not a serious matter.

The most modern system of charging is known as the demand system. It prevents waste just as well as the uniform meter rate, and yet makes a rate much more nearly proportional to the cost. Mr. Codman then cited a number of cities using the demand system, among which were Boston, Brookline, Chester, Haverhill, Walden, New Bedford, Springfield, Bangor, Manchester, Portsmouth, Rutland, Bennington, Middlebury, New Haven, New York, Denver, Cleveland, Minneapolis, St. Paul, etc. The demand system is based on the consumption and also upon the actual maximum load which occurs at the customers' premises. There are from 20 to 40 per cent of the expenses of a central station remaining which are proportional neither to maximum demand nor consumption, and the expenses have to be added somewhere, dividing them between maximum demand and consumption as seems best. If the charge is to be proportional to cost the rates must necessarily vary between customers.

With a demand system under which the charge is based on the maximum demand and the consumption both, the average rate per unit of consumption and the average rate per unit of maximum demand both vary. The customer who gets the lowest average rate per unit of consumption gets the highest average rate per unit of maximum demand, and vice versa. This system is not only best for the electric light companies, it is also best for the public, since it results in lower average prices.

Mr. Codman then described some of the various demand systems, including the Hopkinson and Wright systems and the systems in use by several of the large Edison companies, pointing out their similarity of principle and showing how the same general results may be obtained by widely different divisions of the rates of charging. Service charges are made on the assumption that a part of the expenses are directly proportional to the number of customers, and should therefore be divided directly among the customers at so much per head. This is justifiable, as there are probably expenses amounting to perhaps 10 per cent of the total which are proportional to the number of customers, such as clerical work in making out bills and keeping customers' accounts, meter reading, etc., and it is truly scientific to make a separate charge to cover them. Most companies cover this expense by a slight additional charge per kilowatt-hour and a minimum bill of one or two dollars per month.

Wholesale discounts for quantity of consumption are often given with a demand system and they are justifiable because a large consumer can be supplied at a lower rate per kilowatt-hour than a small customer. When wholesale discounts are given they should be given on the "block" system.

Some companies take the connected load as the maximum demand. This is seldom just; it seriously impairs the flexibility of electricity in an installation and discourages the use of new applications. Estimates of the average maximum demand for each class of customer are likely to be inaccurate unless based upon a wide range of data, and even if once determined the conditions often change. Instrumental measurement of the demand is the best course; the customer can make changes without notifying the company; no extra inspections are necessary, and a better choice in wattmeters can often be made through a study of the demand indicator readings. The customer can connect whatever apparatus he wishes, for the indicator will show only the power supplied to such apparatus as may be simultaneously in actual service. Demand indicators of 25 amp. capacity only cost about $6, and even large instruments of several thousand amperes cost but $30 or $40. They are simple to install, cost very little for maintenance and absorb but a trifle of energy.

In presenting to the customer a contract based on the annual maximum demand, it should be impressed on him that the charge is based on the number of his lamps, but that a concession is made by the company if during the course of his contract he never uses all his lights simultaneously. The company can put it this way: "We realize that in the course of the year it is possible that you will not use all your lamps simultaneously, and if such is the case we will give you the benefit of that fact by basing the charge to you on the maximum number of lamps simultaneously in use as shown by the reading of the demand indicator." If this is done, the customer will look upon the demand indicator as a device for lowering his bills. Mr. Codman closed by discussing the pros and cons of limited vs. measured

demand contracts, pointing out the usefulness of each in relation to regular and abnormal current consumption by customers.

NEW INCANDESCENT LAMPS.

Dr. Louis Bell, of Boston, gave an address upon "Progress in Methods of Incandescent Lighting." He pointed out the need of smaller arc lighting units or their equivalent in high efficiency lamps, and then sketched the German researches upon elements with high melting points in the quest of new filament material. The efficiency of a light producer depends almost entirely upon its temperature. Tantalum was found to be hard, ductile, of a higher specific resistance than platinum, and attacked only by hydrofluoric acid. It is almost infusible, had formerly been obtained only in the form of a black powder, and had to be melted in vacuo in the electric furnace before it could be used for filament work. Dr. Bell described the tantalum lamp and exhibited one of 22 cp to the Association in operation upon the hotel chandelier. Tests which Dr. Bell made upon a number of tantalum lamps showed an average consumption of about 2 watts per cp, and a life of 800 hours on direct current. With a 22-cp tantalum lamp a wattmeter revolves only two-thirds as fast as with an ordinary 16-cp lamp. On alternating-current circuits the results are somewhat less favorable. After about 200 hours the filament gets brittle, and tends to draw tight a little quicker than does the ordinary carbon filament. Such lamps would not be used in service where there is much vibration. They cost about $1 abroad, and at any price above 5 cents per kw-hour are cheaper than the ordinary incandescent, even if the latter is renewed free of charge. The filament is still not quite perfected.

Dr. Bell also exhibited an osmium lamp in operation. It had a consumption of about 1⅔ watts per cp. Osmium is so rare that these lamps are rented, abroad, and it is doubtful if they will come into very wide use in this country. It exceeds the tantalum lamp in brilliancy and is about 24 cp in rating. There is not the same tendency to draw light as in the tantalum lamp. He then discussed the high-efficiency General Electric lamp, with a graphitized carbon filament and predicted that although the efficiency is at present from 2.5 to 2.75 watts per cp, it is probable that within a year or two we shall have a 2-watt lamp. The life is good, on the whole, and a 20-cp lamp is promised soon. It is a good point that the resistance of the filament is nearly uniform, being almost entirely independent of the temperature. It is hard to get long life and low candle-power in a high-voltage lamp. The advent of the high-efficiency lamp means that a great many more lamps can be installed on the present systems, and if the experience of the past is any criterion it is probable that the number of new customers will more than pay for the reduction in price per lamp-hour which will follow. In the use of these very efficient lamps lies the opportunity for fighting cheap gas lights. In the brief discussion which followed the point was brought out that the life of a tantalum lamp on an alternating circuit is only about half that on direct current.

CENTRAL STATION ADVERTISING.

Mr. Converse D. Marsh, of the Bates Advertising Company, New York, gave an address upon the "Best Methods of Advertising for Electric Light Companies." He stated that for many years central station men had devoted their energies largely to the perfection of their equipment, but that the time had come when business getting was a very important question. Advertising is the key to the problem. Mr. Marsh emphasized the value of direct mail solicitation in paving the way toward interviews by solicitors with prospective customers. Unless a solicitor has some such basis upon which to proceed, it will generally occur—and through no fault of his own—that the actual time each day in which he can be face to face with his prospective customer is only a very small percentage of the entire working period. The solicitor doesn't know primarily who are the interested people, and the cost per call is liable to be pretty high.

House-to-house letters are not as effective as mailed appeals. The best plan is to select one branch of applications, as sign work, and to follow up the campaign from 12 to 30 times per year with pointed appeals, each varying somewhat from its predecessor. The time of year should be borne in mind. Power can be talked at any time, but arc lamps are best handled in the dark months. Residence lights would not be discussed as much in vacation time. Newspaper advertising is good, but the results cannot be checked as with direct mail solicitation. Illuminated signs ought to be more widely used by central stations. A monthly business magazine is good if well conducted, but all sorts of tricky and "funny" advertising—the Sunny Jim kind—is likely not to be profitable in the long run. A good plan is to see if an advertisement sounds well when read aloud to a customer.

SINGLE-PHASE MOTORS.

Mr. W. A. Layman, general manager of the Wagner Electric Manufacturing Company, St. Louis, presented a paper on "Alternating-Current Motors, Single-Phase vs. Three-Phase." The writer stated that it was not his intention to advocate the use of single-phase motors to the expulsion of polyphase machines, but rather to advocate the more extended use of single-phase machines and to present the points of preference in favor of the latter.

The principal advantages of a single-phase distribution over that of a polyphase are simplicity, flexibility and saving in the cost of supplying current to customers. The chances of breakdowns, grounds, etc., are reduced in direct proportion to the number of wires used to transmit the power. Crossing over problems and the turning of corners are much more difficult with polyphase distribution. If polyphase generating stations hold to polyphase motors exclusively the distribution system will be reduced to a minimum of flexibility. Single-phase motors on existing lighting lines mean maximum flexibility. Pioneer lines reaching out for new business are almost invariably single-phase. The first customers usually require lighting; later power is wanted. Scattered power calls cannot be profitably handled by extending a second or third phase. Where the load is of such size that the building of two or three polyphase lines is economical, polyphase power can be transmitted without affecting the rest of the system, and power and lighting service made available at any point with a minimum of labor and expense.

With single-phase distribution there is a saving in the cost of the line. The fact that a given amount of power can be transmitted at the same loss with 25 per cent less copper, three-phase than single or two-phase, is not the whole story. The cost of insulation must be paid for, which brings the saving down to about 15 per cent actually, and any special work is more expensive, especially in line erection. The cost of wires for a two-phase system will be about 10 per cent more than for a single-phase line of the same capacity. The principal saving in single-phase distribution is in the transformers. A polyphase motor requires at least twice as many transformers as a similar single-phase motor installation. Between ¼ and 40 hp the increased first cost of transformers runs from 15 to 100 per cent, where a separate transformer installation is put in service for each power customer. No sane central station man will put into service a ½-hp or even a 1-hp polyphase motor and provide transformer service for it. Single-phase distribution also means a saving in investment, interest and depreciation in stock transformers. On the average it probably costs twice as much to erect and put in service two transformers as to install one, allowing for the extra cross arm space and frequent heavier construction. The losses in two transformers are increased about 25 or 30 per cent. There is also a saving in secondary construction cost, including the installation labor and cost of wattmeters.

On a polyphase system the problem of balancing is simplified because of the even loading of the phases, but this is not a serious objection to single-phase work, practically carried out. The chances are that the motors will be evenly balanced, if a little care is exercised. The difficulty of balancing becomes less and less as the power load increases, because each new installation represents a smaller percentage of the total connected power load.

In small installations single-phase generators would naturally be recommended, even though their capacity for the same heating

is from 70 to 80 per cent of the capacity of a polyphase machine. In large installations polyphase generators are desirable even if complete single-phase distribution is contemplated. Feeder circuits can easily be transferred from phase to phase. Single-phase motors give much less trouble than direct-current motors, and are as satisfactory as polyphase machines. The single-phase motor is now as well adapted to variable-speed work as is the polyphase machine.

Mr. Layman then described the torque speed characteristics of the single-phase motor, and discussed the methods of starting these machines without load, either by phase splitting or by the use of the repulsion principle. The split-phase motor gives a starting torque of about 30 per cent of the full-load torque. The Wagner motor starts as a repulsion machine and develops about two or three times full-load torque at starting. This torque increases rapidly during acceleration, until at about ⅓ normal speed, the torque is about five times full load and running torque, then the torque decreases to full-load torque at full speed. The brushes are then automatically lifted from the commutator and the latter short-circuited, so the machine runs as an induction motor. The acceleration is very rapid from zero to half speed, say, 3 or 4 seconds out of 15 required to come to full speed from zero. Non-inductive resistances can be used to increase the power factor, if desired. As a rule motors smaller than 5 hp do not need starting boxes. Some companies will not accept polyphase motors of any size where a single-phase motor of the same capacity can be obtained, notably the Public Service Corporation of New Jersey. The latter supplies light and power from the same mains, and installs separate transformers for power service.

The Wagner Company is now making a line of motors operating at 1,200 r.p.m. on 60 cycles, either reversible or non-reversible up to and including 3 hp, which are developments of the repulsion type of single-phase motors. These are being successfully used for variable-speed fan and light hoisting work, and are controlled either by resistance or auto-transformers. Mr. Layman described the Schuler type of motor at considerable length. This is largely used in sizes above 5 hp; it can be readily reversed and the torque and current well controlled by variable resistance. In this way the current at the start can be held down to about 25 per cent in excess of full-load current, and the starting torque, 50 per cent over full-load running torque. Speed regulation is satisfactory down to about 40 per cent of normal speed at full load.

MAGNETITE ARC LAMP.

Mr. Richard Fleming, of the General Electric Company, presented a paper on "Recent Progress in Arc Lighting." Mr. Fleming pointed out the apparent limit of development which had been attained in the carbon arc, and discussed the flaming arc, in which salts of silicon and cadmium are incorporated with carbon in the pencils. Where color is not material, as in the lighting of large areas out of doors, the flaming arc serves a good purpose. The arc stream is cone-shaped and the life about 16 hours per pair.

The "iron arc" or the magnetite lamp was stated to give the nearest approach to daylight. In this lamp black oxide of iron is mixed with salts of chromium, titanium, etc., so that the life, quality and efficiency of the arc may be increased. The useful life is from 150 to 200 hours. The "carbons" are enclosed in thin iron tubes 8 in. long and ⅝ in. in diameter. A special form of lamp with a chiminey is needed to enable the electrodes to be burned successfully. The upper electrode does not consume, and the electrodes must be separated when not in service or welding takes place. The lower electrode is fed upward by the mechanism, and the arc is not controlled by magnets during operation. The arc is well fixed in position, and first-class effects can be obtained by the use of reflectors. In street work the bulk of the light is thrown down at an angle of 10 or 20° below the horizontal. These lamps are not used on alternating circuits except with the mercury vapor rectifier and constant-current transformer. Designs are now completed for magnetite lamps to operate on 110 and 220-volt circuits. A few years ago nothing much better than 1.75 watts per cp could be obtained, but now in arc lighting ½ watt per cp is readily secured. It is probable that the improvements of the future in the magnetite lamp will be chiefly in the direction of the electrode composition.

Steam Features of the Wanamaker Power Plants.

IN the power plants of both the new stores being erected for John Wanamaker in New York and in Philadelphia, there are some interesting steam features, some of which are departures from ordinary steam practice, while others are the result of necessity to meet certain peculiar and special conditions. In the New York plant, the high-pressure steam piping involves a main and auxiliary header in the boiler room with a ring encircling the engine and pump room. The arrangement of connections to the headers is peculiar. All boiler delivery connections are carried directly to a main 16-inch header, which is divided into two sections, while an 8-in. auxiliary header is

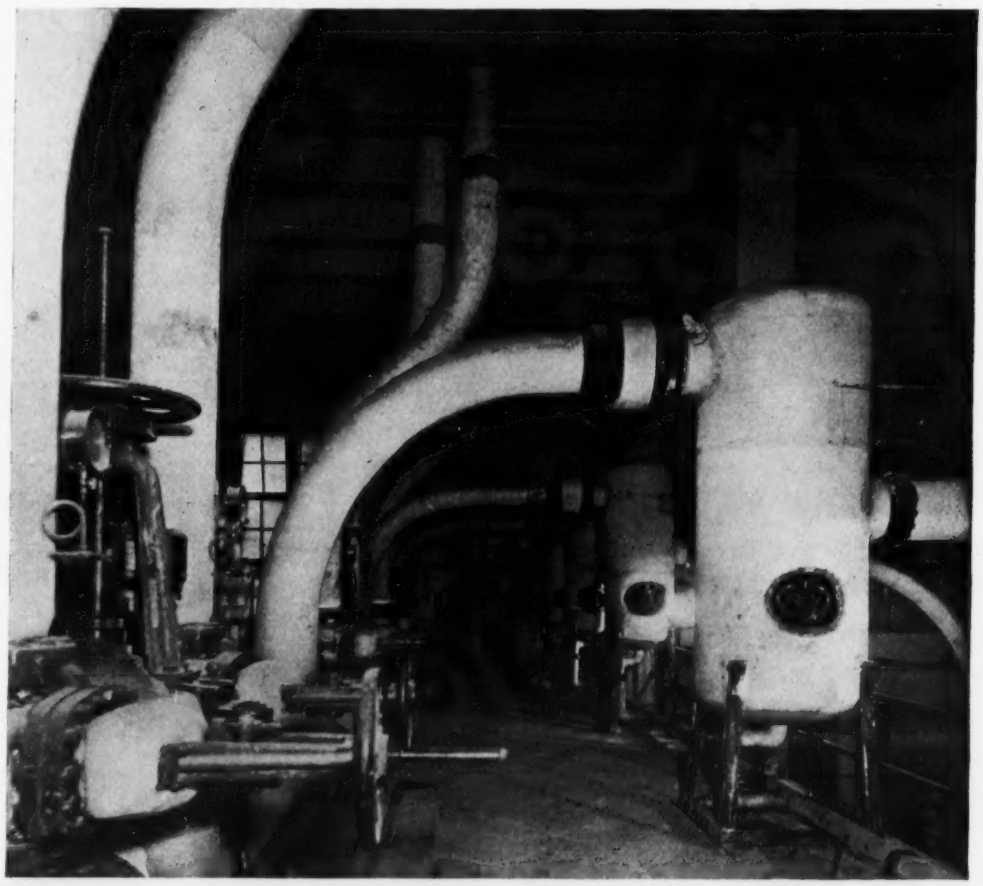


FIG. 1.—MAIN HEADER AND HIGH-PRESSURE STEAM PIPING IN WANA MAKER'S PHILADELPHIA POWER HOUSE.

fed only through the connections which lead into the engine room to the ring main. The purpose of the auxiliary header is chiefly to supply the auxiliary steam-using equipment in the boiler room, rather than to serve as a duplicate source of supply to the engine room; but it does form a connecting link which can be used in cases of emergency to supply one half of the ring main if the other section of the main header is out of service. Each half section of the main header is connected to one leg of the ring main of 12-in. pipe. The auxiliary header is connected between these 12-in. leads, and at this point are auxiliary boiler connections from the end boilers. These consist of regular 8-in. boiler branches which are intended for a by-pass connection to the engine room, if by any chance, both sections of the main header should become disabled. This arrangement effectively safeguards the steam supply without the necessity of running duplicate connections from each boiler to an auxiliary header, two boilers being capable of carrying sufficient overload to prevent a shut down of the plant in such an emergency. The ring main is also sectionalized by means of gate valves so that the operation of units of every class is insured in spite of possible disablement of any particular section of the main.

Features of interest are involved in the construction and arrangement of the engines. On account of the numerous building columns it was necessary to locate the engines so that one of these columns would come between the high and low-pressure cylinders of each engine; but the receiver could not be connected in a direct line between the high and low pressure connections on this account. The receivers were therefore located in each case about midway between the column and the generator base and kept as close to the floor as possible on account of the fact that the basement is located below mean high water. For this reason also it was necessary to keep all pipes above the floor as much as possible and the low-pressure cylinders of the engines were therefore turned bottom side up so as to allow the steam to enter the under side of the chest, and the exhaust to escape from the upper side of the chest, which is rather unusual. It has been found, however, that with the low-pressure cylinder and chest well drained no trouble is experienced on account of this peculiar arrangement.

The exhaust steam supply is greatly simplified by the use of an expansion tank, the function of which as a receiver, muffler tank and oil separator also obtains in the Philadelphia plant. This tank is 25 ft. long and 6 ft. in diameter and into it all the exhaust steam from all steam-using apparatus in the building is carried. This not only simplifies the exhaust connections to the heating system, but also eliminates back pressure which would have been present had a complicated exhaust system been used. All apparatus using exhaust steam is fed from this expansion tank.

The piping systems in the Philadelphia plant are of more than ordinary interest on account of the contracted spaces surrounding the apparatus and the arrangement of the latter in tiers. The high-pressure steam piping, and particularly the steam header on the second mezzanine floor, has a remarkably novel arrangement which has many features to commend it for use in the contracted spaces imposed by conditions in large cities. A view of the piping on this floor is shown in Fig. 1. The boiler connections from the floor above are carried down from stop check valves through 10-in. branches with easy bends. Each boiler delivers steam through a 10-in. stop check valve which prevents the delivery of steam to any boiler not under steam pressure. The 18-in. header is of wrought steel, with flanged cast steel nozzles on the upper side for branch connections and is divided into three sections for sub-division of the equipment if desired. The middle section is fed by two boilers and the outside sections by three boilers each, the latter sections being connected by a 12-in. by-pass at the rear which gives all the advantage of a ring main in flexibility of arrangement. The floor being open on the engine room side, connections to the engines are easily made. Two 12-in. lines from the large engines are first taken through 42-in. vertical steam separators as shown, and the 8-in. lines to the three smaller engines first pass through 30-in. separators whence they are led to the engine throttles. The valves dividing the main header are motor-driven. The boilers may be operated with either natural, forced or induced draft, or with forced and induced draft combined. The boilers being on the fifth floor which brings the breeching about 65 feet above the level of the street, it was out of the question to erect a large smoke stack, so that four short steel stacks are used, necessitating some form of forced or induced draft, or both.

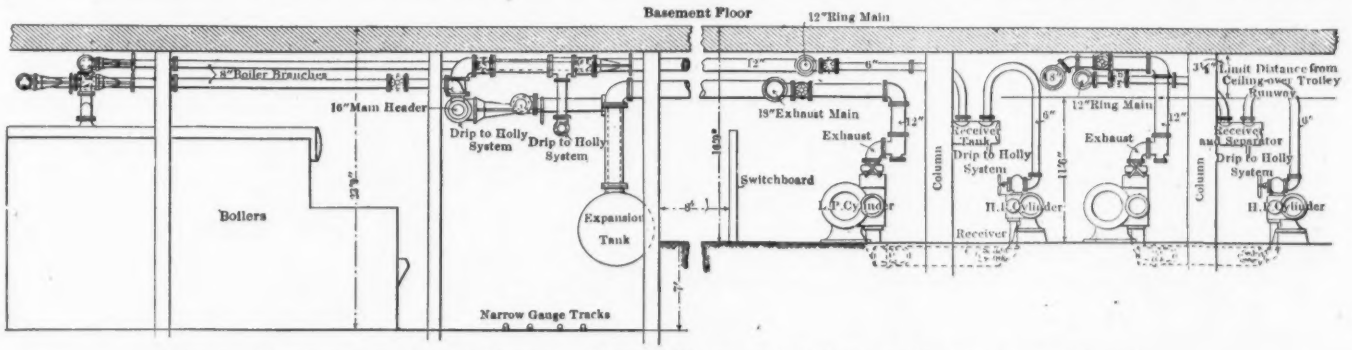


Fig. 2.—Elevation of Steam Piping in Power Plant of Wanamaker's New York Store.

The Wiring and Maintenance of Shunt and Compound-Wound Motors.

By William Kavanagh.

Owing to their ease of erection and operation, manufacturers have adopted the electric motor for power purposes, so that it is to the interest of the motor attendant to learn all that is necessary with respect to motor maintenance and operation. Shunt or compound-wound motors are usually employed and the wiring and care of both types will be considered in a practical way in what follows, so that those interested may be enabled to master the details quickly.

The wires leading to a motor must have a sufficiently large current carrying capacity to permit the maximum amount of current to flow through the motor. To show how to determine the amount of current that the wires must carry we will assume that a motor is to operate on a 250-volt circuit. Since a watt is equal to the product of a volt $\times$ an ampere, and 746 watts are equivalent to one horse-power, dividing 746 by 250 will give the amount of current required to develop one horse-power under that tension; this current is 2.98 amp. Granting that a 25-hp motor is used, the wires will need to be of sufficient size to carry 25×2.98, or 74.5 amp. Motors are, however, required at various times to operate under overloads, and for this reason the current carrying capacity of the wires must be sufficiently large to conduct at least from 25 per cent to 50 per cent excess current, the former figure being required by the Underwriters.

Having determined the amount of current the wires must carry, by reference to a table giving the carrying capacity of wires the size or number of the wire that will conduct this current with safety may be ascertained. Both the gauge number and the cross-section of the wire in circular mils are given. For the motor under discussion the table shows that a No. 5 wire will carry 77 amp., so that by taking wire two sizes larger the anticipated

overload may be carried with safety. This wire will be a No. 3 B. & S. gauge, which will safely carry 110 amp. Should the motor be required to operate under a larger overload a No. 2 wire should be installed.

The mains are led from the switchboard of the generating station to the factory or other building, where they are connected to a panel box similar to that shown in Fig. 1. The main wires are usually run through iron-armored conduit and are connected to the bus-bars, *B B'*, by means of the main switch, *S*, and the fuses, *F*. Any number of power lines may be connected to the

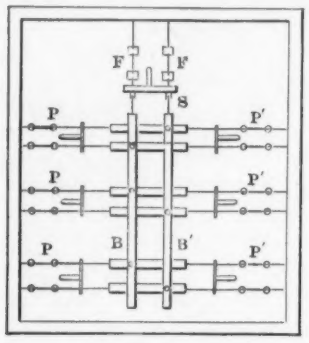


FIG. 1.

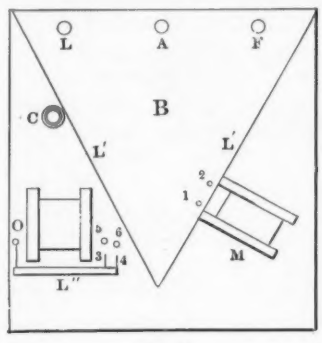
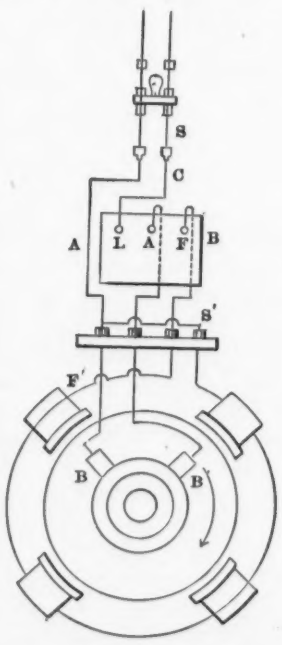
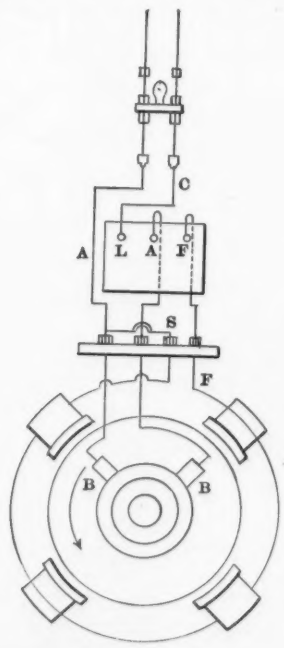


FIG. 6.

bus-bars, provided the current carrying capacity of the mains is not exceeded. Each line leading from the box is connected to the bus-bars by means of a switch and fuse, as shown at *P* and *P'*. From the box the wires are run to the different motors, which may be attached to the ceiling or floor, or may be situated on shelves or platforms.

A diagram of connections for a shunt-wound motor is shown in Fig. 2. The wires from the panel box are connected to the switch, *S*, usually located in a convenient place. The starting box, *B*, is erected near the motor so as to obviate the necessity of long leads, and also that it may be within easy reach of the operator. The leads from the switch, *S*, are connected as follows: The line, *A*, is connected to the brush, *B*, and the line, *C*, is connected to the starting box at *L*; a wire leads from *A* on the starting



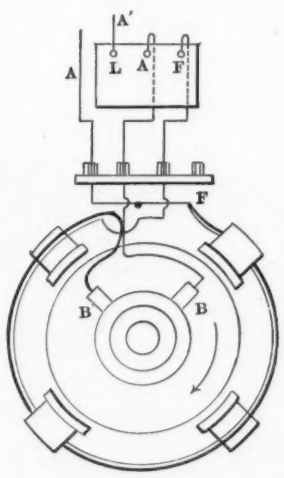


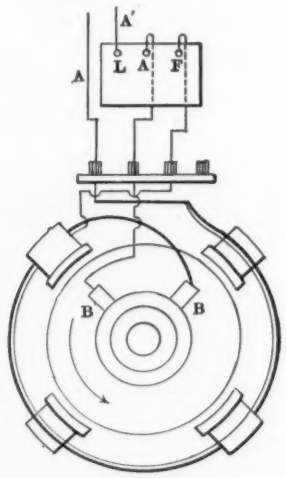
FIGS. 2 AND 3.—SHUNT-WOUND MOTORS.

box and goes to the brush, *B'*; another wire runs from *F* on the starting box to the field wire, *F'*, the other field wire being connected to the shunt, *S'*, as shown. When connected as in Fig. 2 a motor will rotate in a right-hand direction when the armature is viewed from the commutator end. Fig. 3 shows the connections of a motor for left-hand operation. The line, *A*, is connected to the brush, *B*, and the line, *C*, is connected to *L* on the starting box; a wire running from *A* on the starting box is connected to the brush, *B'*, and another wire connects *F* on the starting box with the field wire, *F'*. The shunt, *S'*, is connected to the other field wire, as shown. It will be noticed that the wiring for right and left-hand rotation is the same with the exception of the shunt-field connections.

Fig. 4 is a diagram of connections for a compound-wound motor. The line, *A*, in this case is not connected directly to the armature, as in the case of the shunt-wound motor, but is connected to both field wires as indicated at *F*. The line, *A'*, is connected to *L* on the starting box as in the case of the shunt-wound motor, and a wire leads from *A* directly to the brush, *B*, and the brush, *B'*, is connected to the heavy field or series winding, as shown. The line from *F* on the starting box is connected to the lighter field or shunt winding, as indicated. A compound-wound motor connected in this way will rotate clockwise. A method of wiring the motor for counter-clockwise rotation is shown in Fig. 5. By tracing the connections it will be noticed that the wiring is the same with the exception that the brush, *B*, is connected to the same field wire as *B'* in Fig. 4.

The application of a push button switch for stopping motors is becoming more general because of the resulting convenience. Switches of this type may be located near the operator of a machine or group of machines, so that in case of accident it will not be necessary for the operator to pull the main switch, which





FIGS. 4 AND 5.—COMPOUND-WOUND MOTORS.

might be some distance away. Push button switches find their greatest application in printing establishments, the presses and folding machines being equipped with as many as four, so that the operator may stop the machine from four different places. A diagram of connections showing the application of the push button switch is given in Fig. 6. Here *B* is a starting box, *M* a retaining magnet, *L'* the operating lever and *O* the overload attachment. The lever, *L'*, is held in position by the magnet, *M*, when this is energized. If the current is shunted the retaining magnet, *M*, will be demagnetized and the lever, *L'*, will fly back against the rubber cushion, *C*, thus stopping the motor. The push button is connected to the points 1 and 2, and when the circuit through the button is closed, current from the magnet, *M*, is shunted and the motor stopped, as explained above. The overload attachment, *O*, operates on the circuit exactly like the push button, except that the former is automatic. The amount of current flowing around the magnet determines the distance between the lever, *L''*, and the overload attachment, *O*. Should the current exceed a predetermined amount, the lever, *L''*, will be attracted, thereby bringing the points, 3-4, in contact with the points, 5-6, thus shunting the current through the magnet, *M*, and stopping the motor. An index plate is attached to the magnet, *O*, so that by raising or lowering the lever, *L''*, the amount of current flowing through the magnet, *O*, may be increased or decreased at will.

An Example of House Lighting Design.

By J. R. Cravath and V. R. Lansingh.

In order to illustrate further the principles which have been set forth by the writers in previous articles on residence lighting, the authors have selected for presentation the design of the lighting for a specific house where the planning of the illumination could be treated with a free hand from the beginning. The planning of the illumination for a house or any building should precede that of planning the wiring, because illumination is the ultimate purpose for which the wiring is to be installed. As illumination is the primary object desired, we should work back from the desired illumination to the outlets, installation of wires and machinery and not vice versa, as is too frequently done.

The accompanying plans shown here in Figs. 1, 2 and 3 are of a house recently built in Pasadena, Cal., where the owner desired to obtain excellent illumination with a minimum operating cost. It was recognized at the outset that the first cost of installing the lighting system was small when compared with the running or operating cost from year to year and therefore an effort was made to reduce operating expenses by securing a maximum efficiency of illumination rather than to cut down the cost of installation in general.

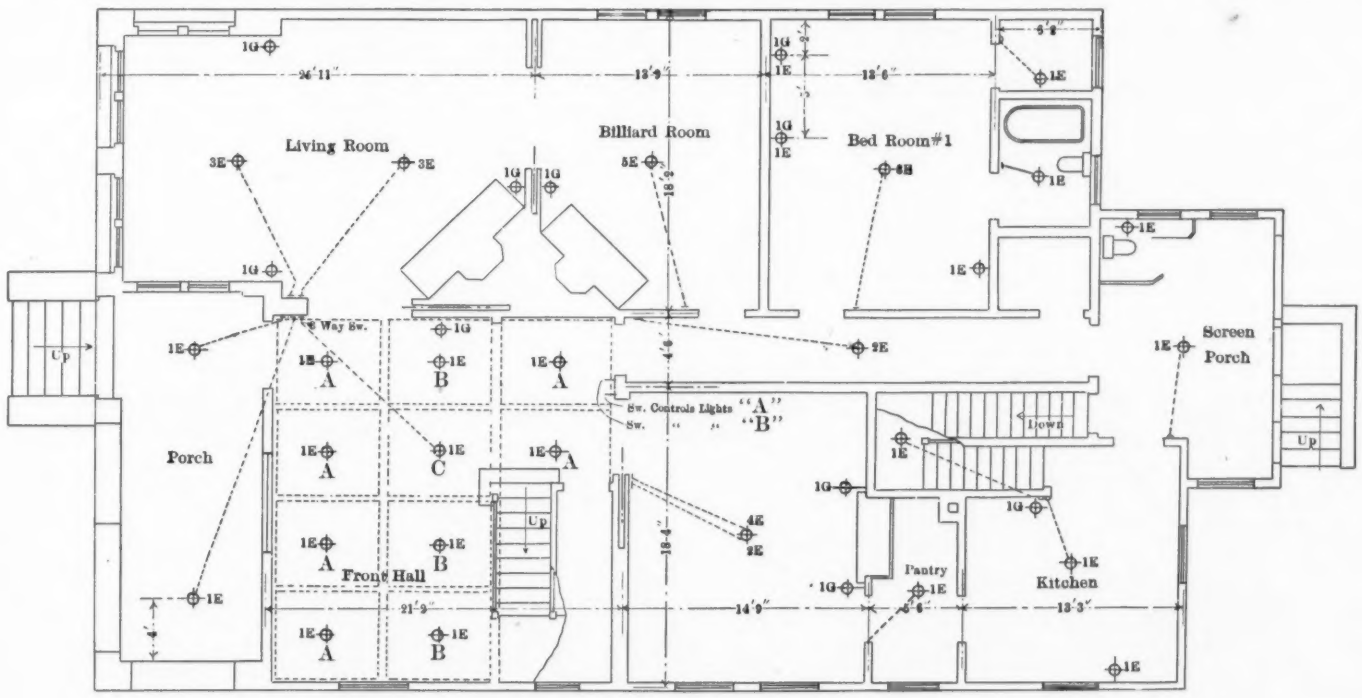


Fig. 1.—Plan of First Floor.

Globes and reflectors were used in the majority of places for directing light in the particular directions desired in each case and so combining economy with pleasing appearance.

The sketches for the chandeliers and brackets as herewith given (Sketches 1 to 8), are rough, free-hand drawings intended only for the purpose of indicating at what angle the globes or shades should hang and indicating only in general the style of fixture; the selection of fixtures being left entirely to owner and fixture dealer with the sketches for guides. The accompanying plans which show the location of the fixtures and switches together with the sketches of fixtures, and the acompanying table or schedule furnish nearly all the information necessary for the contractor so that as regards this part of the work but few other specifications are necessary. It should be noted on the accompanying schedule that in the case of all wall brackets the height of the outlet is in every instance specified and in the case of lights suspended from the ceiling the height of the socket from the floor is given. From such a schedule together with a plan showing the location of lights the wireman can immediately take off all that is necessary for his use and the fixture man has complete specifications except as to the particular design of fixture. The specifications for the wiring are outside the province of this article. Although electric lighting is depended upon almost entirely in this house, a few gas jets have been provided for use should the electric service be temporarily interrupted.

The location of fixtures is marked on the plans by the usual cross and circle. 1*E* marked opposite a fixture on the plans indicates one electric socket, 2*E*, two electric sockets, and so on. Gas tips are indicated by the mark 1*G* opposite the fixture. Push flush switches are indicated by straight heavy lines with dotted lines leading to the lights they control whenever feasible. Snap switches are indicated by half circles. There is need for a standard system of symbols to indicate these matters, but as this subject has never been extensively discussed, the authors will not attempt to propose such a set here, as that is a matter which might well be taken up by the Illuminating Engineering Society.

In planning the location of fixtures, especially that of wall brackets in bed rooms, it is desirable to have some means of quickly showing the probable location of furniture or of trying the furniture in different locations. For doing this either in conference with the owner of the house or even if the entire matter is left to the illuminating engineer, a plan adopted by Mr. J. Kermode of the Cleveland Electric Illuminating Company is to be recommended. Miniature furniture carved out of wood to the same scale as the architect's plans is provided so that beds, dressers, chairs and tables can be ranged in the room under consideration just as they would probably be after the house is finished. In this way both the engineer and the owner can see what is wanted much more quickly than by attempting to picture the situation mentally and measure up the available spaces with a rule. The reasons for adopting the plans as shown can best be seen by considering each room briefly.

Porch.—One light was placed in front of the door to light the doorway and steps. Inasmuch as the porch would probably be used in the evening another light was desirable and placed at the other end. These lights are controlled by separate switches so that only one need be turned on. A ball globe with directing prisms was specified because of its handsome appearance and its ability to throw the light strongly downward, although reflectors would have given a greater amount of downward light. In case it is desired to read on the porch, 16-cp lamps are necessary, otherwise 8 or 4-cp would suffice.

Front Hall.—The lights in the front hall or reception room were placed on three separate circuits. One light which can be

used as a night light, is controlled both from a 3-way switch placed close to the entrance and by another 3-way switch upstairs. Lights *A* were placed on another switch and lights *B* on a third switch. With these three switches it is therefore possible to get a number of combinations of light, and the arrangement is such as not to interfere with the symmetry and artistic effect of the lighting when they are not all turned on. The gas bracket in this hall has a globe which will throw the maximum light sidewise so as to light as much as possible the entire hall.

Living Room.—As this room was large, two chandeliers were used, equipped with cut glass prism balls hanging straight down so as to throw the maximum light on a table or on the book of a person sitting underneath.

Billiard Room.—In order to provide first, uniform table illumination of sufficient strength; second, avoid shadows which are unavoidable when the light is concentrated over the middle of the third table; third, keep the light as much as possible out of the eyes of the players to prevent blinding; fourth, provide sufficient general light in the room to make it possible to count the string easily and, fifth, keep the glassware out of the way

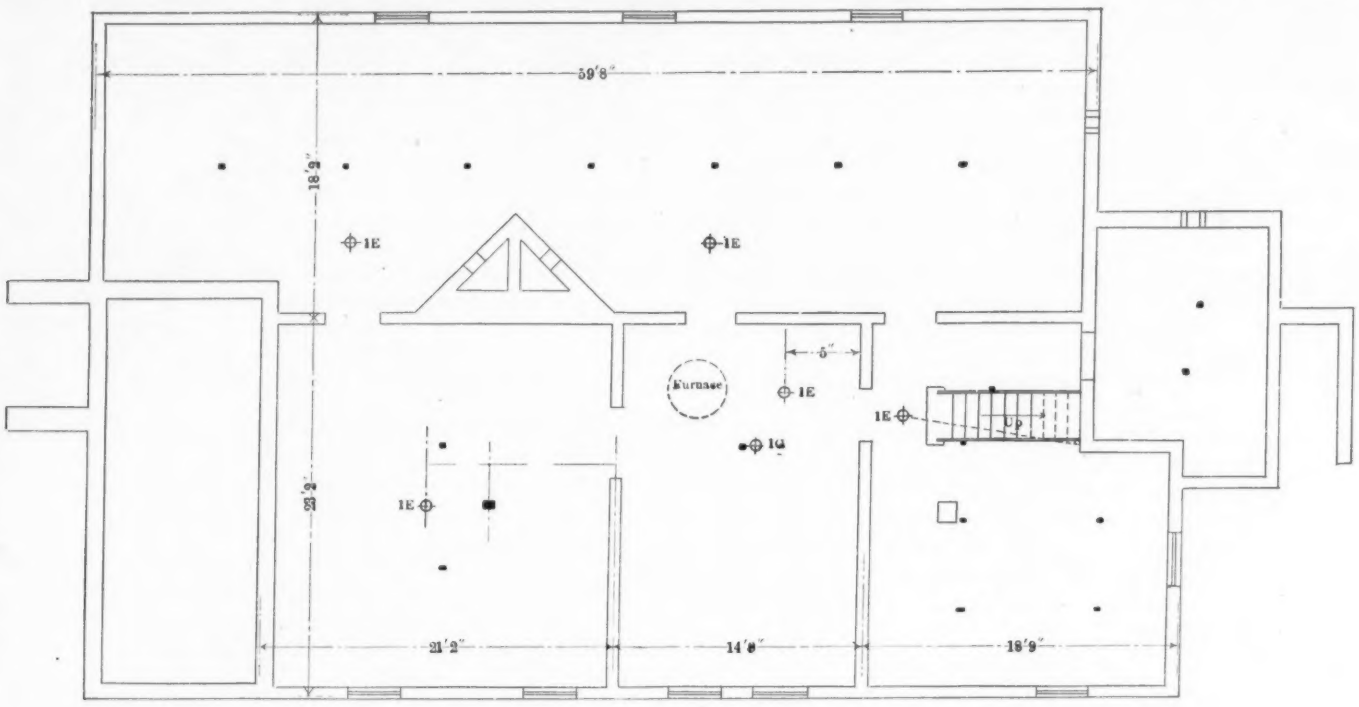


Fig. 2.—Plan of Cellar.

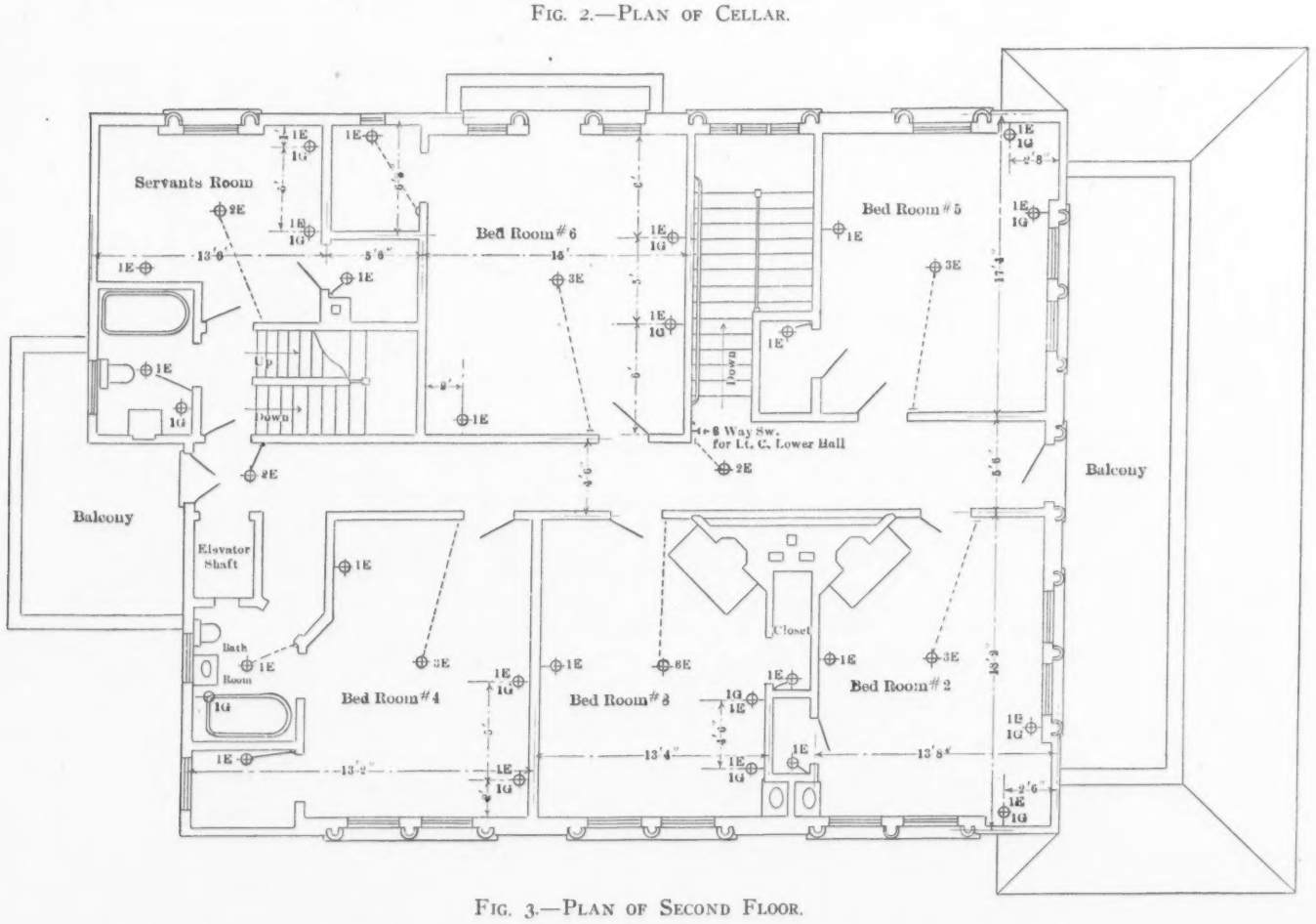


Fig. 3.—Plan of Second Floor.

where it will not be easily broken, the arrangement of the five lamps over the table is indicated in sketch No. 5, was decided upon; the dimensions on the sketch being those found by experience in billiard rooms to give satisfaction. The bed of a billiard

Location.	No fixt.	Lights per fixt., gas	Lights per fixt., elec.	Ht. outlet.	Ht. socket.	Style socket.	Sketch No.	Diam. holders.	Cp. of lamps.	Remarks.
Basement.										
Stairway room	1	..	1	Ceiling	Ceiling	Keyless	..	2 ¼-in.	16	
Furnace room	1	1	..	5 ft.	..	..	..	..	1 5-ft. tip.	
Furnace room	1	..	1	Ceiling	5 ft. 6 in.	Key	Drop cord	2 ¼-in.	1 16-cp.	Cord adjuster.
Front room	1	..	1	Ceiling	5 ft. 6 in.	Key	Drop cord	2 ¼-in.	1 16-cp.	Cord adjuster.
Ash pit	2	..	1	Ceiling	5 ft. 6 in.	Key	Drop cord	2 ¼-in.	2 16-cp.	Cord adjuster.
First Floor.										
Front porch	2	..	1	Ceiling	Ceiling	Keyless	4	3 ¼-in.	2 16-cp.	
Front hall	9	..	1	Ceiling	Ceiling	Keyless	4	3 ¼-in.	9 8-cp.	
Front hall	1	1	..	5 ft. 6 in.	..	..	..	4-in.	10-ft. tip.	
Hall closet	1	..	1	5 ft. 6 in.	..	Key	6	2 ¼-in.	1 4-cp.	
Living room	2	..	3	Ceiling	6 ft. 9 in.	Keyless	Selected	3 ¼-in.	6 16-cp.	Lights to hang straight down.
Living room	3	1	..	5 ft. 6 in.	..	..	Selected	4-in.	5-ft. tips.	
Billiard room	1	1	..	5 ft. 6 in.	..	..	Selected	4-in.	5-ft. tips.	
Billiard room	1	..	5	Ceiling	7 ft.	Key	5	2 ¼-in.	5 16-cp.	
Bed room No. 1...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	6 ft.	..	Pull 18-in. chain	2	1 5/8-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 5/8-in.	1 4-cp.	Angle to be 30° instead of 20°.
Bed room bath.....	1	..	1	Ceiling	8 ft.	Keyless	9	2 ¼-in.	1 4-cp.	
Hall	1	..	2	Ceiling	8 ft.	Keyless	8	1 5/8-in.	2 8-cp.	Hung up and down and not across the hall.
Screen porch	1	..	1	Ceiling	8 ft.	Keyless	Selected	2 ¼-in.	1 8-cp.	Hangs straight down.
Screen closet	1	..	1	5 ft. 6 in.	..	Key	6	2 ¼-in.	1 4-cp.	
Kitchen centre	1	..	1	Ceiling	Ceiling	Keyless	..	2 ¼-in.	1 16-cp.	
Kitchen on sink....	1	..	1	Ceiling	Ceiling	Key	9	2 ¼-in.	1 4-cp.	
Kitchen side	1	1	..	5 ft. 6 in.	..	..	..	..	5-ft. tip.	
Pantry	1	..	1	Ceiling	6 ft. 6 in.	Pull	9	2 ¼-in.	1 8-cp.	
Dining room	1	..	5	Ceiling	..	Keyless	3	1 5/8-in. 2 ¼-in.	4 8-cp. Round frosted. 1 16-cp. Frosted.	
Dining room	2	1	..	5 ft. 6 in.	..	..	..	4-in.	5-ft. tips.	
Second Floor.										
Bed room No. 2...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 5/8-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 5/8-in.	1 4-cp.	30° instead of 20°.
Bed room No. 3....	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 5/8-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 5/8-in.	1 4-cp.	30° instead of 20°.
Bed room No. 4...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 5/8-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 5/8-in.	1 4-cp.	30° instead of 20°.
Bed room No. 5...	1	..	3	Ceiling	8 ft.	Key	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	6 ft. 3 in.	..	Pull 18-in. chain	2	1 5/8-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet...	1	..	1	7 ft. 6 in.	..	Keyless	2	1 5/8-in.	1 4-cp.	30° instead of 20°.
Bed room No. 6....	1	..	3	Ceiling	8 ft.	Keyless	7	2 ¼-in.	3 8-cp.	
Bed room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 5/8-in.	1 4-cp.	
Bed room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Bed room closet ..	1	..	1	7 ft. 6 in.	..	Keyless	2	1 5/8-in.	1 4-cp.	30° instead of 20°.
Servant's room	1	..	2	Ceiling	8 ft.	Key	7	2 ¼-in.	2 8-cp.	
Servant's room	1	..	1	5 ft. 6 in.	..	Pull 12-in. chain	2	1 5/8-in.	1 4-cp.	
Servant's room	2	1	1	5 ft. 6 in.	..	Key	1	2 ¼-in.	2 8-cp.	
Servant's closet ...	1	..	1	Ceiling	7 ft.	Keyless	9	2 ¼-in.	1 4-cp.	
Servant's bath	1	..	1	Ceiling	8 ft.	Keyless	9	2 ½-in.	1 4-cp.	
Servant's bath	1	1	..	5 ft. 6 in.	..	..	..	..	..	
Main bath	1	..	1	Ceiling	8 ft.	Keyless	9	2 ¼-in.	1 4-cp.	
Main bath	1	1	..	5 ft. 6 in.	..	..	9	..	..	
Hall front	1	..	2	Ceiling	8 ft.	Keyless	8	1 5/8-in.	2 8-cp.	Hangs up and down and not across the hall.
Hall rear	1	..	1	Ceiling	8 ft.	Keyless	9	3 ¼-in.	1 4-cp.	
Attic.										
Ceiling	1	..	1	Ceiling	8 ft.	Keyless	Drop cord	2 ¼-in.	1 32-cp.	
Between windows..	2	..	1	about 3 ft.	..	Key wall socket	..	..	..	

SUMMARY.

25 gas outlets.
72 electric outlets.
98 sockets for 97 lamps.

21 4-cp standard lamps.
4 8-cp round frosted.
1 16-cp frosted.
19 16-cp standard.
1 32-cp standard.
51 8-cp standard.

97—Total.

NOTE.—Basement and attic lights will be supplied complete by wiring contractor.

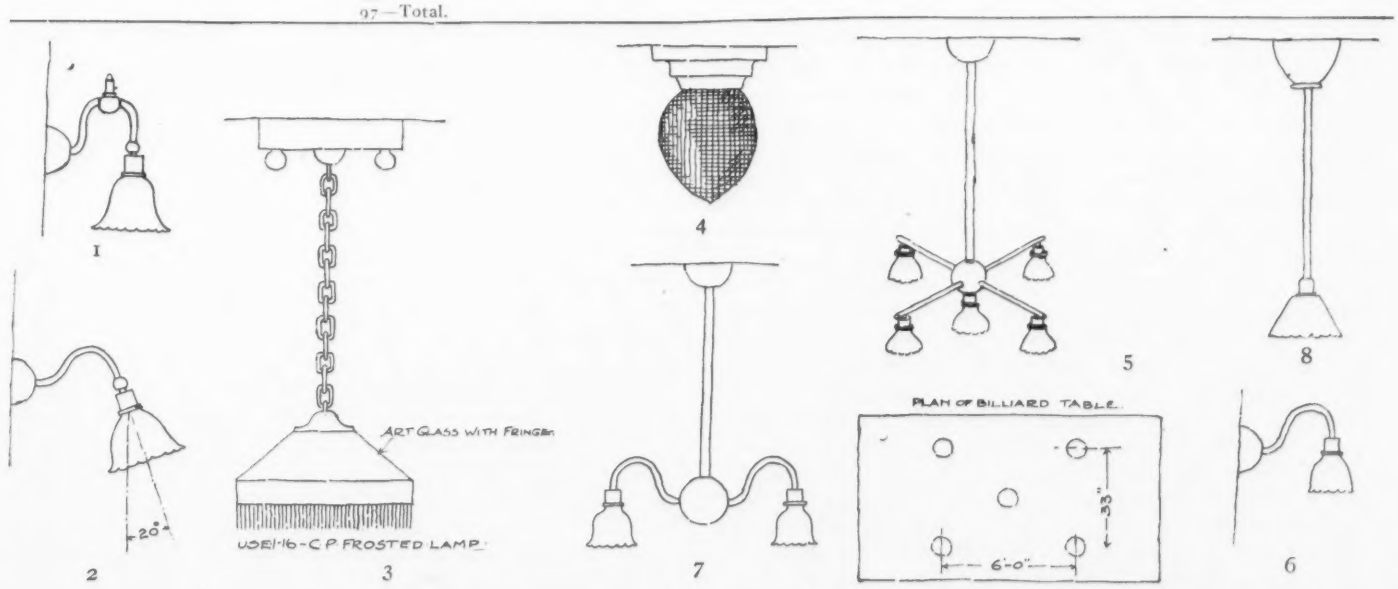


FIG. 4.—SKETCHES OF CHANDELIERS, BRACKETS, ETC.

table is generally 31 inches above the floor and if the lights are from 7 to 4 feet above the bed of the table the results will be satisfactory. Generally speaking, the lights when using the shades specified (give an even distribution of illumination over an area 45 deg. each way from the vertical) should be for a 5 x 10 ft. table 6½ ft. apart lengthwise and 3 ft. apart sidewise. For a 4½ x 9-ft. table they should be 6 ft. lengthwise and 33 inches sidewise. In both cases the sockets should hang 7 ft. from the floor which would bring the reflector about 4½ ft. from the bed of the table.

Bed Room.—The bed rooms were all treated practically alike. The general illumination is given by a 3-light chandelier placed in the center of the ceiling, 8 ft. above the floor. The lights are pointed downward and provided with a rather concentrating form of reflector with 8-cp lamps, which gives a good light throughout the room and provides sufficient concentrated illumination for writing and reading directly underneath. With very dark walls this candle-power might have to be increased somewhat. With light walls it is ample. A bracket is provided on each side of the dresser, the brackets being placed 5 ft. apart and equipped with glassware designed to throw the light on a person standing in front of the mirror. With the form of chandelier used (which is close to the ceiling), sufficient light is thrown on the top of a person's head to light the hair and make unnecessary a bracket or pendant light over the top of the dresser, otherwise such a light would be advisable. Over the head of the bed is provided a 4-cp lamp in a concentrating reflector with a chain socket to provide for reading in bed and for a light of easy access for one awakening in the night. Gas is provided in each room simply for use in case of breakdown to the electric service, which unfortunately is all too common in that city, owing to the tremendous expansion of the business.

Center Halls.—The center halls were lighted by 2-light chandeliers with lamps pointing lengthwise of the hall and provided with concentrating reflectors at such an angle (Fig. 5) as to light the ends of the hall.

Bath Rooms.—A 4-cp lamp placed in a prismatic reflector upon the ceiling is all that is necessary unless the room is used for

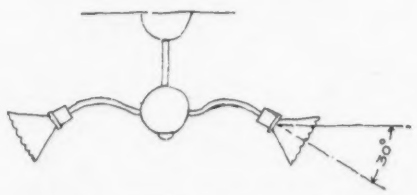


FIG. 5.—CENTER HALL CHANDELIER.

shaving. In the latter case two 4-cp frosted lamps placed one on each side of the mirror are sufficient.

Kitchen.—One lamp was placed in the center of the ceiling of the kitchen for the general lighting of the room. The reflector chosen, No. 7381, lights evenly the entire lower portion of the room. A lamp was placed in a bracket over the sink to give a strong light where most needed in dish washing.

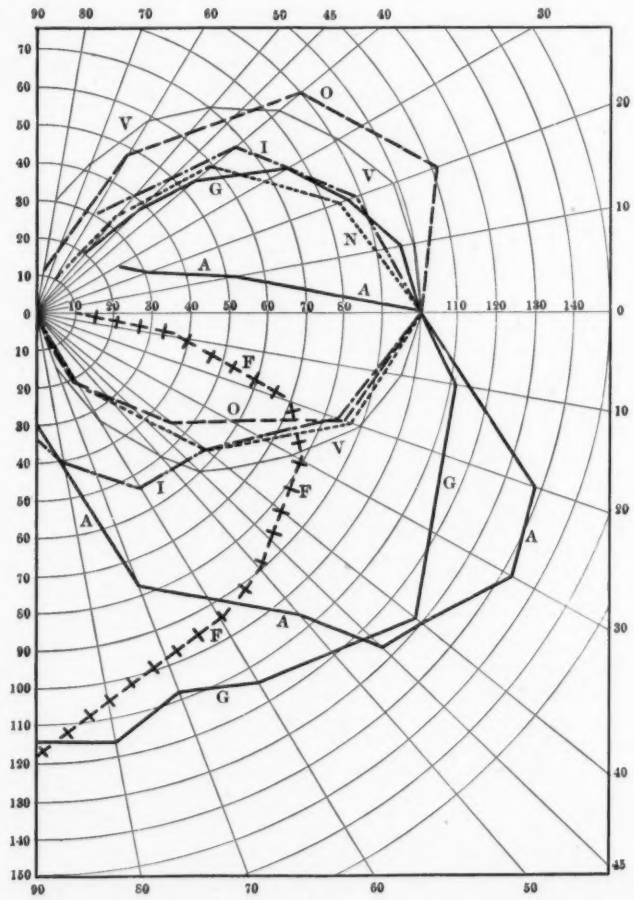
Dining Room.—The principal lighting of the table is by an art glass dome in which is a lamp pointing straight down and equipped with a prismatic reflector of a type which will light the whole top of the table evenly and allow some to go through the art glass for decorative purposes. The general lighting of the room is by means of round frosted lamps at the ceiling as indicated in Sketch 3. These notes, in connection with the plans and sketches will enable the reader to make a thorough study of the methods and reasons for arrangements adopted.

It is of interest to note the candle-power of the lamps actually used after a study of the lighting effects had been made upon the completion of the house. In this house the changes made in the schedule were as follows:

In the basement and attic all the lamps were changed to 8-cp, for general illumination, special illumination being taken care or by an extension plug and lamp on portable cord. As the porch is not used for reading, the lamps were changed from 16 to 8-cp. In the living room a special form of fixture being adopted, the number of lamps of 16-cp was increased from 6 to 8. In the halls, as the walls and ceiling were light 4-cp instead of 8-cp lamps proved ample. In the kitchen the candle-power of the lamp over the sink was increased from 4 to 8 cp.

Comparative Distribution of Light from Various Illuminating Sources.

The accompanying curves showing comparatively the distribution of light from various sources of illumination, formed part of a paper printed in a German gas journal, the author being Prof. H. Drehschmidt, of Berlin. The measurements were made by means of an arrangement due to Schmidt and Haensch, employing a mirror attached to a jointed parallelogram whereby the light at any angle is directed horizontally for photometric



DISTRIBUTION OF LIGHT FROM VARIOUS ILLUMINATING SOURCES.

measurement. For comparative purposes the horizontal intensity is 100 hefners for each source.

Of the several curves *W* is that of the ordinary Welsbach lamp, *O* that of the osmium lamp, *N* that of the Nernst lamp, *A* that of the electric arc, *I* that of the electric incandescent carbon filament lamp, *F* that of the electric flaming arc and G that of an inverted incandescent gas burner.

Commenting on these curves, Prof. Drehschmidt says that of the sources *I*, *O* and *N* (with vertical magnesia rod) send about as much light upwards as downwards. The electric flaming arc, *F*, though it sends all its light downwards, gives very poor lateral illumination and strongly illuminates only a limited region below the lamp. The electric arc, *A*, is best at about 30° below the horizontal, but is pretty poor immediately beneath. The distribution of light by the inverted gas incandescent lamp is materially better than the distribution from the other sources as indicated by the curves plotted.

The Design of a Small Central Station.—II.

By James F. Hobart.

ENGINE, PULLEY AND BELT.

WHEN selecting an engine for any given duty, the principal things to be considered are that the engine pulley is of sufficient width of face and diameter to give the necessary belt surface for transmitting the required amount of power; the proper location of the engine in regard to the power distribution, and the direction of rotation of engine in order to avoid the use of crossed belts and to secure proper belt lengths. In order to secure a belt surface, it is absolutely necessary that the belt have sufficient width and velocity to pull the load without too great a tension to the inch of width. The catalogues of more than one reputable manufacturer of transmission machinery, in their tables of "horse-power of pulleys" assume as a base in the calculations 88 pounds pull to the inch of width of double belts, and 66 pounds to the inch for single belts of leather. A power transmission based upon these figures will do the work expected, but the belt will not have the lasting qualities which are desirable in a transmission of this kind. The belt which is operated under 88 pounds working strain will be in constant need of belt dressing, repairs and other attention; hence it is in order to "use wider belts and larger pulleys." The above statement is constantly met with in engineering books, and engineers preach it about every time one of them talks about belting, but it does not seem that many of the eminent writers and talkers have placed themselves on record as to what working strain should be permitted in any belt.

The working strain for double belts which will give universal satisfaction, with little or no cost of repairs, is forty pounds pull to the inch of belt width. Single belts are not considered as they should never be used in power work where any considerable quantity of power is to be transmitted for the reason that it does not pay to bother with light belts or with the "single belt" pulleys which are supposed to be furnished for single belts to run upon. Specify double-belt pulleys and use double belts upon them and give a working pull of 40 pounds to the inch of belt width and the transmission thus arranged will never give trouble and the belts will never slip.

Let this working pull be applied to the engine belt of the factory under consideration. The engine pulley is eight feet in diameter and the engine speed is 130 r.p.m. What should be the width of the belt to deliver 100 hp to the main shaft? With a pulley diameter of 8 feet, the belt speed at 130 r.p.m. would be 3,267 feet per minute. A hp of 100 would require a force of 3,300,000 foot pounds to the minute, or a pull of 1,010 pounds on the belt. Giving a working strain of 40 pounds to the inch of width, the belt should be 25¼ inches wide to meet the requirements. As the belt actually used is only 16 inches wide, the pull to the inch of width must necessarily be 63⅛ pounds to the inch.

The working pull given above is not at all bad as engine power transmissions go, but it would be desirable to increase the diameter of the engine pulley to 10 feet in order to attain a belt speed of about 4,000 feet to the minute (4,080.3 feet) which would call for a belt width of 20.22 inches for a total pull of 808.8 pounds. Twenty inches of belt width on a pulley 10 feet in diameter would be the ideal drive for the engine in question.

From the main shaft it was necessary to take power in three portions, somewhat as shown by Fig. 1, the illustration representing in plan and elevation (not to scale) the distribution strains which had to be resisted by the timbering upon which the shafting was placed. The pull upon the engine belt is given on the elevation drawing. It is 1,010 pounds on the angle made by the belt. Reducing the pull of the belt, or more strictly speaking, resolving it into horizontal and vertical fractions or components, it is found that the horizontal pull to be resisted by the journal supports is about 877 pounds. But there is another strain to be taken into account—that of the belt due to its weight, which includes the strain of the belt due to the tightness with which it is placed upon the pulleys.

The working strain of any belt is something entirely separate from the pressure horizontally upon the journals due to the power pull (torque) of the belt. When the belt is placed upon its pulleys (assumed to be both in the same horizontal plane), the strain due to the tightness of the belt is due entirely to the weight of the belt to the running foot, the distance apart of the pulleys and the flatness of the inverted arch or catenary formed by the suspended belt between the pulleys. This is easily calculated by the formula pertaining to the catenary, provided the weight of the belting is known and the deflection of the belt has been measured. When the belt is at rest both folds are under equal strain, but when the belt is in motion the working fold flattens its catenary while the idle or return fold of the belt increases its catenary, or drop.

Rather than figure the strain caused by each and every belt, the writer has adopted the "rule of thumb" method of assuming the strain on the working fold of the belt to be 88 pounds to the inch of width, and the strain on the idle or return fold to be 44 pounds to the inch, making a total of 132 pounds pull to the inch of belt width to be sustained by the journal bearing

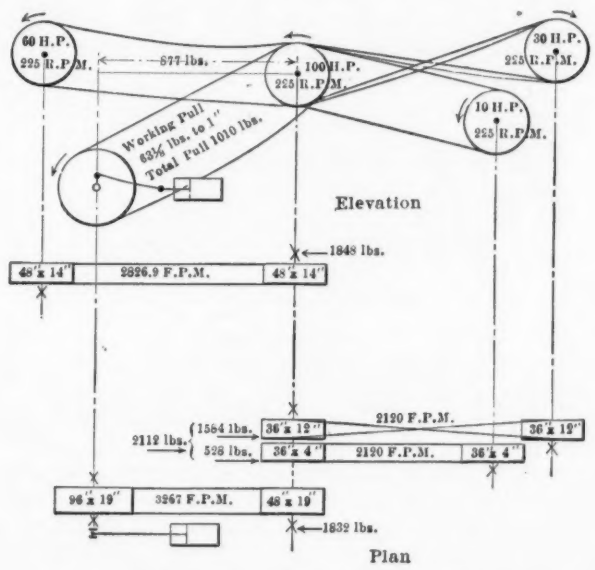


FIG. I.—JOURNAL STRAINS IN POWER DISTRIBUTION.

supports. In other words, if the belt and its shafting and pulleys were carried on the tops of piers, there would be a force of 132 pounds to the inch of belt, tending to tip over the piers in question.

The 16-inch engine belt, then, instead of pulling 1,010 pounds toward the engine, should be regarded as pulling 2,112 pounds and its horizontal component will be taken as 1,832 pounds instead of the 877 shown on the elevation in Fig. 1. The arrow at the bearing near pulley from engine (on plan, Fig. 1) indicates the direction of the force of 1,832 pounds acting at that point. The belt on the 48-inch by 14-inch pulleys has a velocity of 2,826.9 feet per minute, and its pull when handling 60 hp would be about 50 pounds to the inch of belt width. Assuming this belt to have a pull of 132 pounds on each of its 14 inches, the total strain on the bearing at that pulley would be 1,848 pounds, as indicated at the direction arrow at the pulley in question.

The two 36-inch pulleys remain to be figured. The belt speed over these will be 2,120 feet per minute, and the pull will be 467 and 156 pounds respectively. Applying the "rule of thumb" gives a pull of 1,584 and 525 pounds respectively on a 12-inch and a 4-inch belt, a total pull of 2,112 pounds to be sustained by the bearing close to the two pulleys. It is true that some of the pull of the engine belt and the 12-inch and 4-inch belts will be carried or neutralized by the belts pulling in the opposite direction, but no account is taken thereof, save to let it go toward a small factor of safety when designing a pier to carry the middle bearing of the shaft, as shown diagrammatically by Fig. 2.

SHAFT BEARING PIERS.

It was necessary that the shaft be located 16 feet from the ground or floor line, and a masonry pier could not be used on account of the cost of brick; therefore a timber trestle was constructed as shown by the illustration, the native long-leaf yellow pine being used. This material weighs five pounds to the superficial foot, one inch in thickness; therefore the timber weighs about 60 pounds to the cubic foot. The pull at the top of the pier, 16 feet from the floor line, has been shown to be 2,112 pounds. The frame work, exclusive of the sills,

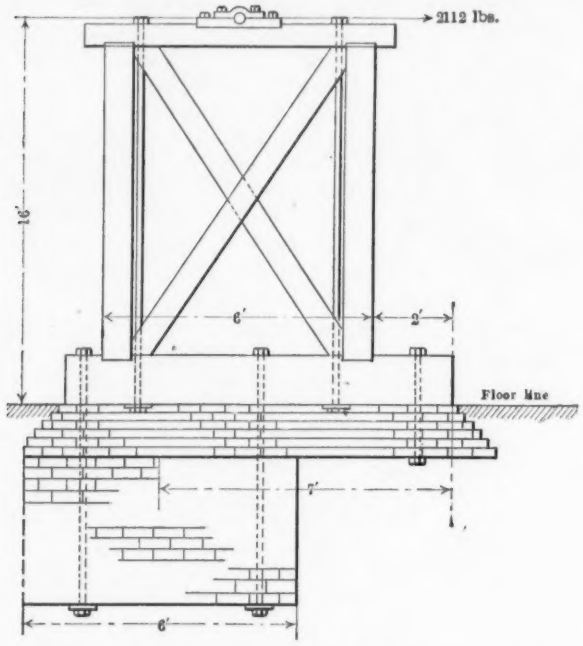


FIG. 2.—WEIGHTING A SHAFT BEARING FOUNDATION.

weighs about 1,940 pounds and its moment about the bottom of the right hand end of the sill is about 9,700 pounds. The sill and the foundation proper, which is 12 inches deep, weighs 2,512 pounds, and its moment at the point indicated above (at the end of a 5-foot lever arm) is approximately 10,048 foot-pounds.

The moment of inertia of the shaft about the same point with the radius of gyration of 16 feet is about 33,792 foot-pounds, whereas the timber work and foundation possess only about 19,748 foot-pounds resistance. The trestle would, therefore, tip over, or at least its left-hand side would be lifted from the ground by the pull of the belts.

To prevent the tipping of the trestle, a section of brickwork was built under one end of the trestle as shown by Fig. 2. To find the number of brick necessary for this sub-foundation it was assumed that the center of gravity of the sub-foundation fell in a vertical plane 7 feet from the right-hand end of the trestle sill; hence dividing 7 into the deficiency above noted (13,944 pounds), it is found that 1,992 pounds should be added as shown by Fig. 2, in order that the pull of the belts could be balanced. A factor of safety of at least 3 should be employed in cases of this kind, which gives 5,976 pounds to be added to the foundation. As 1,000 bricks are supposed to weight 4,000 pounds, it would require about 1,500 bricks to make the foundation heavy enough to withstand safely the pull of the two belts, 4 inches and 12 inches wide, respectively.

To connect the timber work with the brick foundation, three anchor bolts were inserted as shown by the drawing. The sill was dropped over the tops of the foundation bolts, which were previously set by means of a templet, and the sill was bored in accordance with the same templet. The 16-foot rods were also put in place before the sill was placed upon the foundation prepared for it. The trestle has proved itself ample for the work it has to do, and as yet it has not shown any indication of failure. The supports at either end of the shaft were carried by timbers framed between posts, both the top and bottom of which could be securely fastened so that no weighted base was necessary.

SHAFT BEARINGS.

There is another point which goes far toward making a well-running power transmission, and that is the kind of journal bearings used. In all heavy transmissions, and in all light ones, too, whenever possible, avoid the use of the drop hanger. Use the pillow block and there will be no trouble with the shafting. The first choice is the self-adjusting, ring or chain self-oiling pillow block, but good service may be derived from the wick oiling pillow blocks if the management will not stand the slight additional expense of ring or chain oilers. Even plain "rigid flat boxes" are preferable to drop hangers, and if the boxes are carefully set in place and fitted to the timbers upon which they rest, and fitted with self-feeding lubricators, they may be depended upon to stay where put for a long time to come.

The post-hanger may be sparingly used, but it is about as well to use flat boxes for post work also, the lubricators above mentioned taking care of the bearings in a most perfect manner. Fig. 3 is a sketch of one of the lubricators as applied to a flat box used as a post hanger. The device consists of a brass shell, pipe-threaded into the metal of the box-cap. These lubricators are made to fit ⅜-inch, ½-inch and ⅝-inch pipe threads. The lubricant comes in the form of little solid cylinders about three diameters in length. To apply to a new bearing, first fill the journal thoroughly with oil, then pull back the spring in the lubricator by means of the projecting wire. In Fig. 3, *A* indicates the common flat box which is to be used as a post hanger; *B* represents the lubricator shell; *C* the stem above described by means of which the helical spring inside the lubricator is compressed for the insertion of one of the grease candles, *D*.

When the lubricator is first attached, two of these candles should be inserted, as one of them is well used up in filling the passage to the shaft. After once filled, the oiler need never touch the lubricator until he sees by the position of the wire, *C*, that the candle of lubricating material has melted and been forced into the bearing. In Fig. 3 is also shown the proper method of hanging a flat box when it is to be used as a post hanger. The box, *A*, is bolted to the post, *E*, and further supported by means of the board or plank, *F*, which is fastened securely to the post by means of spikes, lag-screws or bolts as occasion may demand.

It will not do very well to use a self-oiling pillow block of

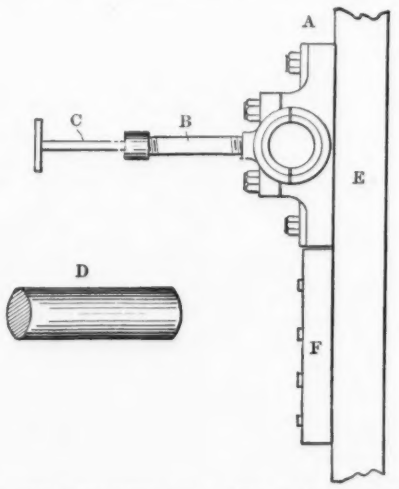


FIG. 3.—FLAT BOX ARRANGED AS A POST HANGER WITH POSITIVE LUBRICATOR.

the chain or ring-oiling type as above directed, although some forms of capillary boxes work very well in the position shown by Fig. 3. Such boxes will work as post hangers when the shape of the oil reservoir is such that it will still hold some lubricant with the box set on end as shown. To be sure, ring-oiling boxes can be used as post-hangers if the reservoir business be dispensed with and the automatic lubricators used with

them as in Fig. 3; but this makes a rather expensive arrangement and should be resorted to only in order to get out of some difficulty, such as shortage of proper boxes, wrongly selected material, or changes from original design, which, by the way, are sometimes quite necessary in the field, and which cannot well be done without ordering other bearings. In such cases the expedients above noted and described will be very welcome to the engineer who, in order to produce results, must make changes quickly and as best he may. He can talk with the office about it afterwards.

The flat boxes work very well "stood up," and if a good tight liner is well fitted between box and cap below the shaft, the oil will not give trouble by running out under the cap. For very heavy work, the boxes may be let into the post from ½ inch to 1½ inches, according to size of box, instead of using the piece fastened on as at *F*, Fig. 3. This is the usual practice for shafts 2 7/16 inches and greater, in diameter. Where adjustment is wanted, the cut for the box may be made long enough to include a wedge or taper key at the end of the box, the wedge or key to be slotted and fastened by means of a lag-screw. The wedge may also be used with the fastened-on piece, *F*, Fig. 3; but wedge adjustments are seldom necessary with shafts less in diameter than the figure given above.

It is frequently desirable to substitute the rigid flat box or the self-oiling, self-adjusting pillow block for a drop hanger,

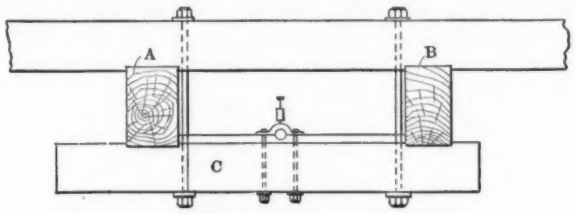


FIG. 4.—FLAT BOX USED AS DROP HANGER.

and Fig. 4 shows a good way of accomplishing it. Two short blocks are let into the lower side of the timber from which the shaft is to be suspended, as at *A* and *B*. Another short piece of timber, *C*, is also boxed on to the blocks, *A* and *B*, and a bolt is put through both timbers, as shown close to the blocks, *A* and *B*. It is then an easy matter to place the boxes or pillow blocks each as shown by Fig. 4. The depth of blocks, *A* and *B*, and the length of timber, *C*, may be according to circumstances.

The depth of the blocks, *A* and *B*, need be only sufficient to allow the application of the lubricator as shown by the engraving. Their distance apart can well be made longer than is necessary for operating a wrench on the box bolts, for a little room on either side of a journal bearing never yet came amiss.

There is usually a hole through the bottom of every flat box, and it is frequently in order to take advantage of the fact by inverting the box, as shown by Fig. 5. To do this trick, the hole in the bottom of the box, which is usually filled with babbitt metal, is drilled out and tapped to fit a ½-inch or ⅝-in. pipe, a piece of which, long enough to pass through the timber, is screwed into the box as shown. A coupling is placed on the upper end of the pipe and one of the automatic lubricators

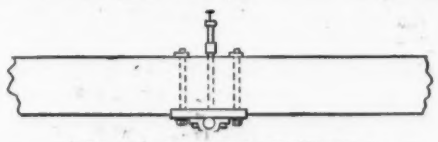


FIG. 5.—INVERTED FLAT BOX.

is screwed into the coupling. The box, let into the bottom of the timber, or held by two boards fastened on, makes a very neat arrangement for hanging a shaft close to the under side of a timber. A factory recently erected by the writer did not contain a single journal bearing except rigid flat boxes. The larger sizes were wick-oiling (capillary), but they all were rigid, and without even the pretence of adjustability. These boxes were all carefully set, level and in good alignment, and a nicer running lot of shafting never was started up. Not a bearing had to be changed. Every belt ran as true as a die, and there was no trouble with belts running off one side of its pulley.

It is a lamentable fact that the selection of belting is usually governed almost entirely by the cost of the several varieties and kinds of belting. There are certain places where leather, rubber and stitched cotton belts each are preferable, but the man who frequently has the selection of belting, purchases one kind right through, for each and every imaginable kind of service. Thus, cotton belts may be selected for all the main drives except the engine. When this is the case, use belt tighteners

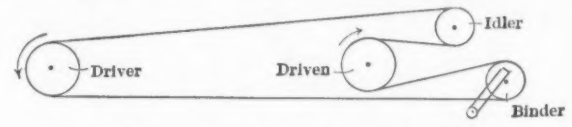


FIG. 6.—GETTING RID OF CROSSED BELT.

freely. They will save valuable time which otherwise will be spent in taking up belts, not once, but many times.

Fig. 1 shows one of the main belts crossed and a 14-inch belt at that. This was in accordance with the designs furnished, but the writer dispensed with the crossing of the belt by adding two idle pulleys, arranged as in Fig. 6, one of the new pulleys also doing duty as a tightener. This arrangement worked perfectly, and proved an excellent investment as regards extending the life of the belt to which the scheme was applied. The arrangement is so clearly shown by the engraving that no further description is necessary.

New Methods in the Care of Brush Arc Generator Commutators.

BY C. M. GREEN.

THE number of Brush arc generators now in use and the importance of the condition of the commutator to the operation of this machine makes new and better methods in the care of the commutator well worth attention.

The present style of three-finger pressure and two thin leaf brushes used together as one brush has a much lighter bearing against the commutator, and consequently wears it less, giving at the same time a better contact than the old solid three-finger type. If, then, the commutator receives attention for a few minutes each day just before the generator is shut down, it will wear till the copper tips of the wood blocks are almost worn through, the best record being, so far as known, three years and six weeks without renewal, and sixty-three days at ten hours a day without resetting the brushes. However, when new wood blocks or insulating segments are necessary, they are sometimes too high, owing to the worn condition of the copper segments.

The segments may be taken down in the following manner: First, remove the brushes; see that the cover is on the regulator to keep out the dust, put over the regulator and rheostat a cover of carriage cloth, a similar cover being provided for the operator. A flat wood rasp should be held as shown in the illustration, one end being held firmly against the brush holder stud, while the other is brought down until it makes a light cut, only the high parts being touched till the entire ring is cut to a uniform diameter. All of the rings should have finally the same diameter. This should be followed by sandpapering as shown in the second illustration.

Wrap a piece of No. 3 flint paper about a piece of hard wood sixteen inches by 1¾ inches square. If the commutator has four rings, use sheets 16 in. by 9 while if it has three rings, use sheets 11 in. by 9. Working in succession all sides of the block and moving it lengthwise will use up economically the entire sheet. Pressure on the ends of the stick should be equal, else the rings will be cut unequally; also the entire number of rings on the commutator should be sandpapered at the same time, except when removing the wire edges, at the finish. To disregard these points is likely to ruin the segments and blocks. Next, test all the segments and

blocks carefully with a straight edge to see if they line up. Finish the commutator with No. 2-0 flint paper. Finally spread a little oil across the flint paper that you have been using and apply it to the commutator; it will remove the particles of dust, giving sufficient lubrication and polish.

The commutator of a machine in commercial use should be put in first-class condition at the end of each run, as soon as

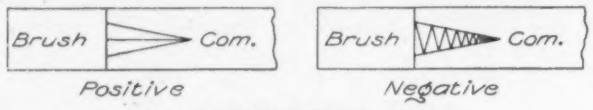


FIG. 1.—CHARACTERISTIC SPARKS.

the current is shut off. A piece of No. 2-0 flint paper wrapped about a stick as previously described, should be applied to the commutator until the rings are bright and smooth. The brushes need not be removed. The machine should be cleaned immediately after it is stopped since five minutes at that time will give better results than half an hour when the machine is cold.

The polarity of the Brush arc generator is readily seen by the sparks, the negative spark having a zigzag center while the positive spark has a straight center, as the diagrams in Fig. 1 show. The negative spark should be horizontal on the brush.

The setting of the brush-holder studs and brushes is given in the following paragraphs because of the influence it has on the proper running of the commutator, although the methods are not new.

The brush-holders must line up to a straight edge and their

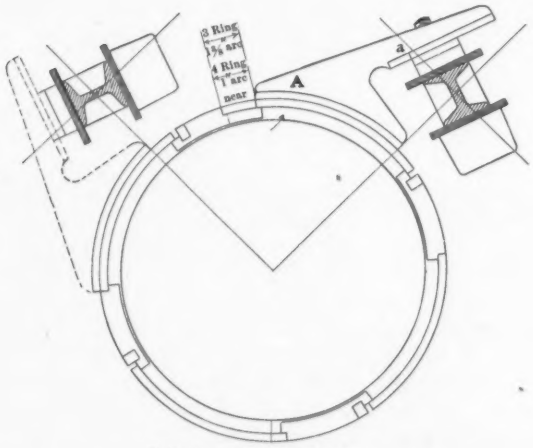
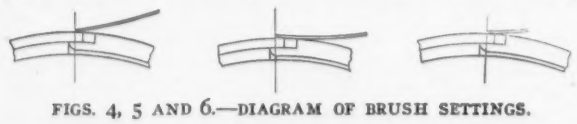


FIG. 2.—COMMUTATOR.

edges must be parallel to the centre line of the commutator, and the bearing surfaces of all the brush-holders must give the same angle with the commutator when tested with a gauge as shown in the diagram, Fig. 2.

Line up the brush-holders, using a wood block and hammer, if necessary. Remove the clamps, placing them so that each may readily be returned to the brush-holder from which it came. (These are not interchangeable.) Place the stud gauge on one of the inner brush-holders, sliding it along until it touches the commutator; turn the brush-holder stud till the gauge shows the slant of the brush-holder to be correct; move the rocker till the end of the gauge is even with the edge of a segment on the commutator, then clamp the rocker. Turn the other brush-holder stud till the gauge,



FIGS. 4, 5 AND 6.—DIAGRAM OF BRUSH SETTINGS.

sliding on the inner brush-holder, rests on the commutator, when the end of the gauge should reach to the edge of a break in the commutator 90° from its former position. Change the position of the arm if necessary with a hammer and wood block. Then adjust the studs parallel to the commutator by packing the shoulders of them with mica if necessary, or turning the mica washers, using the stud gauge on the inner and outer brush-holders. As the gauge slides along the brush-holder it should meet and fit the commutator exactly, the mark being at the edge of the brush-holder. Also examine the slant with respect to the commutator (by means of the gauge) of each brush-holder when the commutator and brush-holder are parallel, correcting them by packing mica beneath them so that they will all slant the same (Fig. 3).

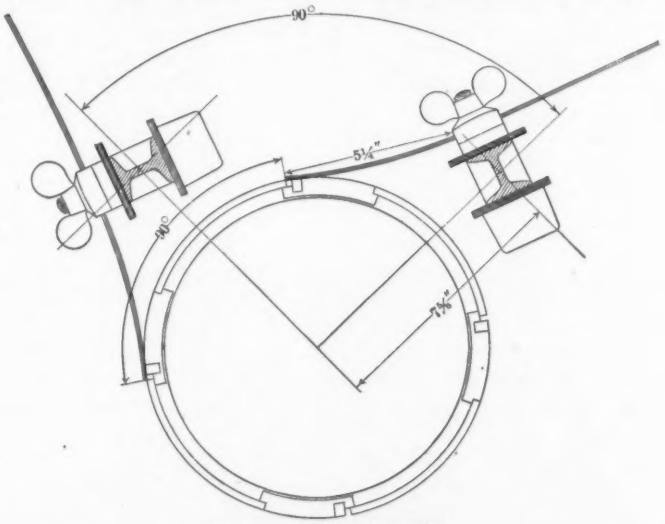


FIG. 3.—BRUSH SETTING.

The brushes should be so arranged that the ends of the thin leaf brushes reach to the ends of the three-finger pressure brush yet do not overlap. The brushes should line up with the segments in an axial direction and should not overhang.

In setting the brushes, commence with the inner pair and set one brush 5 5/16 in. from the holder to the tip of the brush, then rotate the rocker or armature until the tip of the brush is exactly in line with the end of a copper segment. The other brush should be set on the corresponding segment 90° removed (the same relative position on the next segment forward) but if the length of the brush from the holder is less than 5 5/16 in. move both brushes forward until the length of the shorter one from the holder is 5 5/16 in. Now set the two outer brushes in the same manner, clamping them firmly in position and by using a straight edge or steel rule, all the brushes may be set in exactly the same line and firmly secured. If the spark on one of the brushes is a trifle longer than the others, move the brush forward a little so as to make the sparks all of the same length at full load. Equality of the spark lengths is desirable, but not absolutely essential; it gives at a glance an indication of the running condition of the machine.

Brushes should bear on the commutator from the end back from ⅛ to ¼ of an inch, or in one case, Fig. 4, they will drop into the commutator slots and pound the copper tip of the wood

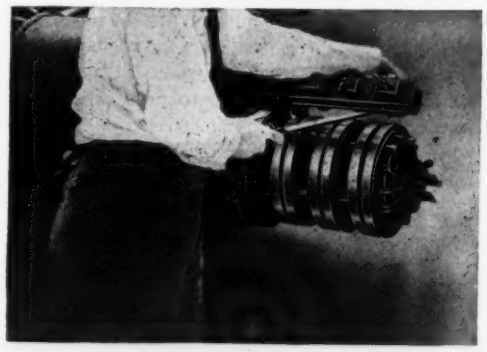


FIG. 7.—FILING THE SEGMENTS.

blocks, causing the fingers of the brushes to break off. In the other case, Fig. 5, the brushes bearing too far from the ends, or being set too long, the point of the brush will not be in contact with the segment, thereby prolonging the break and allowing the spark to follow to the brush tip with consequent burning of both segments and brushes. Both of these faults, together with the brush set correctly, Fig. 6, are shown in the diagrams above.

Wiring With Flexible Conduit and Armored Cable.

By LOUIS J. AUERBACHER.

THERE are two kinds of flexible conduit—fibrous and metallic. Two much-used makes of fibrous conduit on the market are known by the trade names "Circular Loom" and "Flexduct" and are illustrated by Figs. 1 and 2, respectively. Both of these fibrous conduits possess the same general characteristics; both are approved by the National Board of Fire Underwriters, and both conform to the following data:

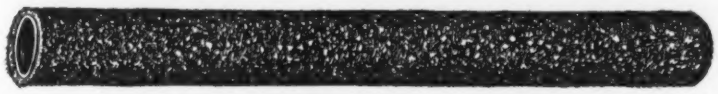


FIG. 1.—"CIRCULAR LOOM" FLEXIBLE FIBROUS CONDUIT.

FIG. 2.——"FLEXDUCT" FLEXIBLE FIBROUS CONDUIT.

Inside Diameter.	Outside Diameter.	Feet per Coil.	Largest size of wire taken for easy pulling.
¼	17/32	250	No. 14 B. & S.
3/8	5/8	250	" 12 "
½	¾	200	" 8 "
5/8	7/8	200	" 4 "
¾	1 1/16	150	" 2 "
1	1 3/8	100	" 00 "
1 ¼	1 11/16	100	200,000 c.m.
1 ½	2 1/16	...	400,000 "
1 ¾	2 ½	...	600,000 "
2	2 ¾	...	800,000 "
2 ¼	3	...	1,100,000 "
2 ½	3 ¼	...	1,300,000 "

In addition to being used for complete wiring installations, this type of flexible conduit is also very largely used in connection with moulding and exposed wire work as described in previous articles. Fibrous conduit must not, however, be used in damp places or in fire-proof buildings. Its particular field is finished frame buildings, where it can be easily fished from outlet to outlet. Fibrous conduit having an internal diameter less than ⅜ in. will not pass inspection, and when installing fibrous conduit it is best not to draw in the wires until the building is finished, so that any nails driven through the conduit will be located when the wires are being pulled in. On the other hand, if the wires were pulled in prior to the completion of the building, any nails piercing the conduit might easily cause trouble, if not actual damage. Duplex wires must not be used in fibrous conduit; single-braid, rubber-covered wire should be installed instead, double-braid wire not being required by the rules.

FIG. 6.—ELBOW CLAMP FOR FLEXIBLE METALLIC CONDUIT.

FIG. 8.—STRAIGHTAWAY JUNCTION BOX FOR FLEXIBLE METALLIC CONDUIT.

Flexible metallic conduit is known to the trade as "Greenfield" conduit and is made in the following sizes:

Outside. Diameter.	Inside Diameter.	Feet per Coil.	Largest wire accommodated— 1 wire.	2 wire.	3 wire.
5/16	.5	200	..	..	..
3/8	.6	200	..	..	..
½	.95	100	8	12	..
¾	1 ¼	50	2	10	12
1	1 ½	50	00	6	8
1 ¼	1 ¾	50	200,000 c.m.	3	5
1 ½	2.05	50	400,000 c.m.	1	3
2	2.55	50	800,000 c.m.	200,000 c.m.	00

Greenfield conduit may be used on any kind of installation, and for many purposes it is far superior to rigid conduit. Though the first cost of the former is somewhat higher than that of the latter, when all conditions are taken into account it will be found to be cheaper. This type of conduit does not require the

The "fishing" of conduits in finished houses constitutes one of the most difficult tasks of a wireman. The journeyman must be a good carpenter and mechanic as well as wireman to do a neat job. He must understand the construction of partitions, floors, casings, etc., and be an expert at taking up pockets. Where hardwood floors are encountered the taking up of pockets is rather difficult, since these must be relaid so as to make the opening inconspicuous.

A steel tape about ¼ in. wide and 50 ft. long known as a "snake" is employed for "fishing"; the ends being heated and turned over as shown in Fig. 3. It is oftentimes necessary to fish from two pockets so as to engage the end of one snake in the end of the other. A loop of twine is fastened to the end of one snake and the turned-in end of the other snake is opened slightly. The snakes are then worked toward each other and turned about until the ends engage, as indicated by Fig. 4, when one is pulled through from outlet to outlet and the tubing fastened to it for pulling in. For vertical fishing a chain is employed. This is fed in at the outlet until it reaches the floor, the sound made by it in striking the floor serving to indicate where the pocket should be taken up and the chain pulled through.

FIG. 7.—BUSHING FOR FLEXIBLE METALLIC CONDUIT.

Folding door recesses are frequently used to bring circuits in. The doors may be taken out so as to give the wireman plenty of room, and the conduit should be well secured so as not to interfere with the sliding of the door. It is also well to locate switches at sliding doors for this reason. Iron outlet and switch boxes should be used in connection with fibrous conduit. It is not necessary to have the cut-out boxes lined with iron, since asbestos will answer as well.

FIGS. 3 AND 4.—STEEL "SNAKE" EMPLOYED FOR "FISHING" CONDUIT.

FIG. 5.—COUPLING FOR FLEXIBLE METALLIC CONDUIT.

cutting of threads, or fitting of elbows, and can be easily and quickly installed. Since the conduit is made in long lengths, few couplings are necessary. The writer does not look with favor on flexible conduit for new fire-proof buildings; but for all other classes of buildings where a conduit job is wanted, flexible conduit is not only cheaper to install, but also makes a good installation. In order to dispose of short ends which quickly become scrap, one of these should be coupled to a new coil. Fig. 5 shows a coupling suitable for this purpose as well as for joining coils of conduit.

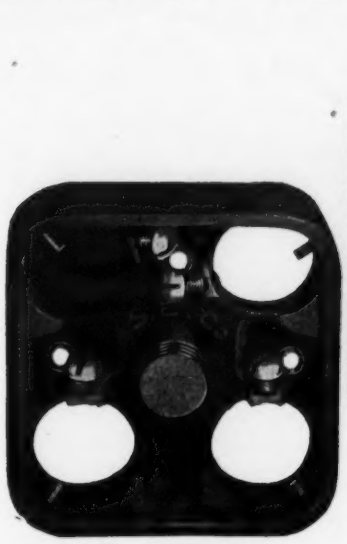


FIG. 9.—OUTLET BOX.

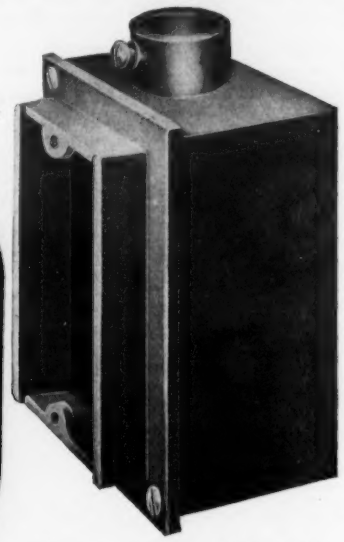


FIG. 10.—FLUSH SWITCH BOX.

To cut Greenfield conduit a fine hacksaw should be employed,

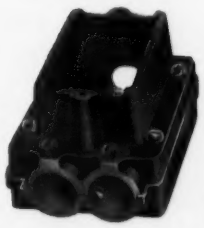


FIG. 11.—SPLIT CLAMP SWITCH BOX.

FIG. 12.—LOCK NUT AND BUSHING FOR IRON-LINED PANEL BOXES.

and in making a turn or elbow the conduit should be fastened in three places, or a special fitting shown by Fig. 6 may be used for this purpose. It is needless to say that all conduit should be securely and rigidly fastened. The same rule about pulling in wires after the building is completed applies to Greenfield conduit as to the fibrous conduit. An approved form of outlet bushing for Greenfield conduit is shown in Fig. 7.

Double-braid, rubber-covered wire must be used in flexible metallic conduit, and no conduit smaller than ½ in. internal diameter will be passed by the Underwriters. At all outlets iron outlet boxes or switch boxes must be installed, and the conduit must be securely fastened to the boxes and must be provided with proper bushings. Figs. 8, 9, 10 and 11 show a number of iron outlet boxes suitable for this purpose.

Conduit should not be employed in places subject to dampness, unless the conductors are lead-covered. Flexible metallic conduit is less liable to give trouble through accumulated moisture

FIG. 13.—TWIN CONDUCTOR ARMORED CABLE.

than rigid conduit, since it is ventilated over its entire length. The writer has seen many short-circuits in rigid conduit due to accumulated moisture. Greenfield conduit should be properly grounded as required by the Code. At iron-lined panel boxes the use of a bushing shown by Fig. 12 in connection with a lock-nut makes a connection of this kind easy.

A good system of wiring may be installed by employing flexible steel armored cable. Fig. 13 illustrates a steel-armored cable known to the trade as BX. This cable is made with conductors of No. 6 B. & S. gauge to No. 14, and since the greatest field for this cable is for circuit wiring No. 14 is the size most frequently used. Where the runs are over 100 ft. No. 12 cable should be used. Steel-armored conductors are cheaper to install than fibrous tubing, and make a much more satisfactory job. The saving in labor over that required to install fibrous tubing is considerable, and for finished private house work there is nothing superior, since the conductors are easily fished. BX cable is made by winding a sheet steel sheathing around a pair of specially insulated conductors.

Steel-armored conductors should be continuous from outlet to outlet, without a splice. When it is desired to tap a circuit this should be done by means of a junction box. At all outlets suitable

FIG. 14.—OUTLET BOX FOR ARMORED CABLE.

outlet boxes must be used. Fig. 15 shows a duplex enameled iron bushing used in connection with the outlet box shown by Fig. 14, and Fig. 16 shows a single bushing used in switch boxes and at panelboards. The sheathing of BX cable must be grounded, and at all outlet and switch boxes a clamp must be employed to hold the cable in place. This clamp may also serve to properly ground the cable. At panel centers the sheathing of the cables is connected together by means of a copper wire soldered to each cable as indicated in Fig. 17. A good type of

FIGS. 15 AND 16.—BUSHINGS FOR OUTLET BOXES.

switch box for BX cable is shown by Fig. 18.

To properly cut BX cable a fine hacksaw is necessary. Where dampness is present BXL cable should be employed. This cable has a lead sheath between the conductors and the steel armor

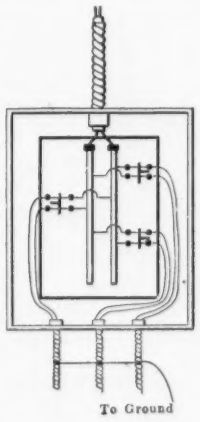


FIG. 17.—GROUNDED ARMORED CABLE.

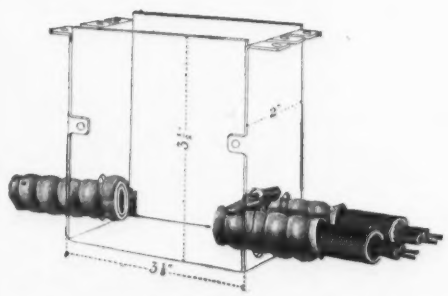


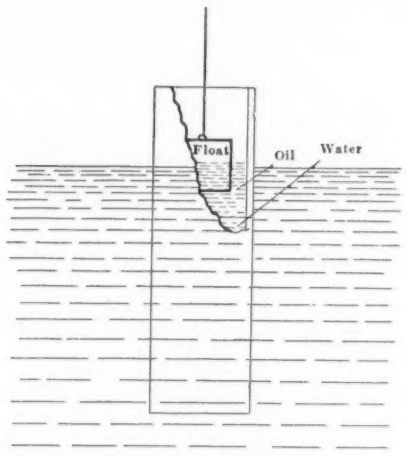
FIG. 18.—CLAMP SWITCH BOX FOR ARMORED CABLE.

and is especially applicable for stables and other places subject to fumes. This cable will not fit the outlet box illustrated by Fig. 14; a box similar to that shown in Fig. 8 may be employed, the single bushing shown by Fig. 16 being used at the outlet.

LETTERS ON PRACTICAL SUBJECTS.

WATER LEVEL RECORDER.

It is often desired to obtain a continuous record of the water level of rivers. Large water power companies require a continuous record of the level of the forebay, and in various places this record is of great value. Numerous devices for obtaining such a record are on the market, and nearly all are based on the use of a float. The objectionable feature of these floats is that they freeze in winter and the record is interfered with. The writer has used the following scheme with much success: An iron pipe 6 in. to 8 in. in diameter, large enough to give plenty of clearance around the float, is suspended in the water to a



WATER LEVEL RECORDER.

depth of several feet. If necessary the river bed may be excavated. Into this pipe is poured kerosene to a depth of about 12 in. The float is then put into the pipe. Kerosene being lighter than water remains on top and the float rests in the oil. Since oil does not freeze at temperatures as low as 30° below zero F., the float will not freeze in and the record will not be interrupted. The iron pipe must, of course, extend deep enough into the water to prevent the oil running out when the water is at its lowest. The graphic record should be checked with a sight reading gauge at least twice every 24 hours.

Albany, N. Y. Edward Wiltgen.

PECULIAR BEHAVIOR OF INCANDESCENT LAMP.

I do not know whether it will be considered justifiable to turn your correspondence department into a question box, but a matter has come to my attention recently which I thought might be of interest to some of your readers, and at the same time I am desirous of gaining any information possible on the subject. The point in question is this: In my room several incandescent lamps are supplied from a common feeder, and I noticed that one of the lights flickered in a most annoying manner. As a rule only one of the lamps is in use at one time, and I laid the trouble to very poor regulation. Using two or more lamps, however, destroyed this theory, since the lamp in question was the only one which did not glow steadily. Changing the lamp from one socket to another showed that the trouble lay with the lamp and not with the supply circuit in any way. The filament is apparently in good condition so far as can be observed by external inspection. I hardly think the cause of the disturbance lies in the connections leading into the bulb, as shaking the lamp has no appreciable effect on the behavior. The fluctuation does not exist at all times and is more pronounced at certain times than at others. The light will drop to about half candle-power, sometimes suddenly, as if due to a very brief short-circuit on the line, and at other times the dimness will last for a second or nearly as long. The lamp is of 16 cp and operates at an e.m.f. of 52 volts. I should be glad to hear if any of your readers has had a similar experience, and if so what reason has been assigned for the peculiar behavior of the lamp.

Wilkinsburg, Pa. C. A. Carpenter.

A STRANGE ENGINE POUND.

For over a year we were worried by a most puzzling case of engine pounding on a high-speed engine. We had tried time and again to get rid of the trouble, but never succeeded in remedying it. Finally an expert was called in and after a long search, he declared that the pound was caused by the sound of the exhaust into the open air telephoning back on the pipe to the engine. This pipe, which was made of tinned iron, was very long and extended vertically from the engine on the ground floor to the roof of a high building. We disconnected the exhaust pipe, changing it so as to run underground to the outside of the building, and we had no further trouble.

Lancaster, Ohio. Royal Wolfe.

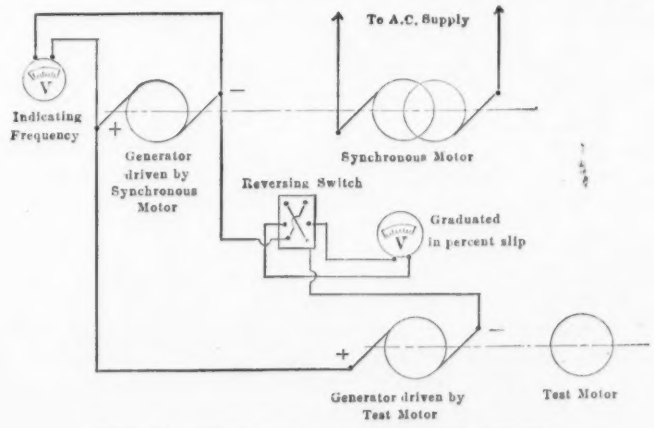
REPRESENTING ARMATURE WINDINGS.

I have read the article by Mr. Burke in your issue of March 3 and have also carefully considered the diagram given. I must say, however, that I cannot see the connection between his diagram and the one given by me in the February 3 issue, the only similar points being that both have two circles and some curved lines. Mr. Burke's diagram has to do with telegraphic work, while mine is a representation of the windings on an armature—two subjects as widely different as it is possible to get them. Even if I had seen Mr. Burke's diagram before it was published, I have serious doubts whether I should have connected it with the idea I had in mind. It is only necessary to place the two diagrams side by side to note their extreme dissimilarity, and I was greatly surprised to read that Mr. Burke has through some mistaken idea connected them.

Baltimore, Md. E. K. Stembridge.

METHOD FOR DETERMINING THE SLIP ON INDUCTION MOTORS.

At present there are several methods employed for determining the slip on induction motors, each of which has its advantages and disadvantages. The writer has devised a very accurate and convenient method by which the percentage slip may be read directly from a scale. Fig. 1 is a diagram of the apparatus, which consists of two similar magneto generators connected in series opposition. Millivoltmeters are connected as shown, the voltmeter across the reversing switch indicating the difference between the e.m.f's of the two generators. The e.m.f. produced by the magneto generator with a millivoltmeter as a load will be proportional to the speed and will be a direct indication of the speed. The two magneto generators are first direct-connected and run at synchronous speed and their voltage is adjusted so as to read exactly the same on the voltmeter used for the slip measurement. At this same speed the deflection on the second voltmeter is noted and this reading, which is maintained through-



DETERMINING THE SLIP OF INDUCTION MOTORS.

out the test, serves both to show that the synchronously-driven generator is being run at the desired speed and that the line frequency is correct. The e.m.f. registered on the voltmeter at syn-

chronous speed represents 100 per cent slip at a certain frequency, and if this point is marked and the scale divided into 100 equal parts the voltmeter will read directly in per cent slip. For any other frequency the maximum deflection will be equal to the e.m.f. produced at synchronous speed times the ratio of the frequencies, and the scale may be divided into an equal number of parts as before. As many scales as frequencies will be required and these can be plotted on concentric circles on the face of the voltmeter with the zero percentage lines coinciding.

Where the ratio of the number of poles in the synchronous motor and the tested motor is not indicated, it is necessary to connect the shaft of the generator driven by the test motor to the shaft of the test motor by gears in the same ratio. It will be found convenient to use the same speed changing device as is employed with liquid tachometers. It is preferable not to resort to belting on account of the possible belt slip that is likely to occur. All the apparatus except the generator driven by the test motor may be conveniently and permanently placed. With the alternator field rheostats within reach and the voltmeters side by side, one observer is all that is required for obtaining quick and accurate readings. The most convenient method for adjusting the voltages of the two magneto generators is by shifting their brush positions. It is well to check each machine occasionally to see that the needle coincides exactly with the 100 per cent slip mark when running at the synchronous speed for that frequency scale.

Lynn, Mass. J. D. Shaw.

MOTOR OPERATION IN TEXAS.

With reference to G. McL.'s trouble in operating an electric pumping plant in Texas, as recited in the Questions and Answers page last month, I would suggest that the reason for decreased output of motors driving centrifugal pumps may be due either to worn pump runners or to the lowering of the water level. Either cause will be made manifest by a decreased flow of water and decreased registration on the electric motor. I have investigated many such cases and have found that the above causes were invariably present. This suggestion may possibly be of service to him in locating and remedying his trouble.

Rochester, N. Y. R. J. C. Wood.

MR. M'KEEHAN'S PROBLEM IN MOTOR CONTROL.

I enclose herewith a sketch (Fig. 1) showing a solution to Mr. McKeehan's problem of controlling a 5-hp, three-phase induction motor from two points. It is assumed that no auto-starter was used in connection with this motor, and that the distance between the two controlling points will not exceed, say, 500 ft., and therefore the cost of running two additional wires would not be a serious objection. The two double-pole, double-throw switches are used for reversing purposes only, while the two three-pole, double-throw switches are used for starting and stopping the motor. Assuming that switches *A, B, C* and *D* are thrown to the left, it is obvious that the circuit will be closed and the motor will then run in a given direction, but if either of the reversing switches, *A* or *B*, is thrown to the right the motor will run in the opposite direction. To stop the motor at *F* the switch, *D*, is thrown to the right, and to start the motor from *E* the switch, *C*, is thrown to the right also. If the motor is stopped at *E*, by throwing switch *C* to the left, it may be started again at *F* by throwing switch *B* to the left, or vice versa. With this scheme it is impossible to short-circuit the system and the motor will always be ready to start from either location, provided that care be taken to see that all switches are fully closed in one of the two positions, and not left partly open.

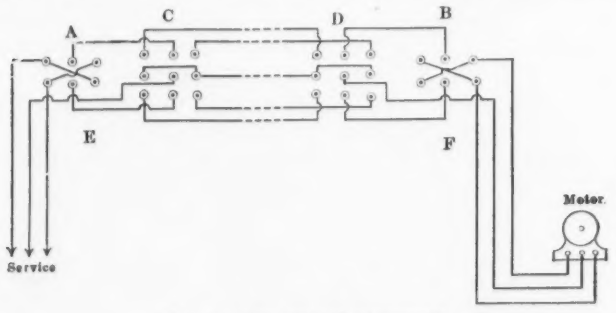


FIG. 1.—MR. ELLIS' SOLUTION.

New York City. Benson O. Ellis.

[A similar solution was received from Mr. F. M. Farwell, Schenectady, N. Y.—Editors.]

I submit the enclosed diagram (Fig. 2) as a solution of the problem in three-phase induction motor wiring as given in the March 3 issue of the Electrical World by Mr. D. C. McKeehan. By tracing the connections as indicated by the diagram, it will be found that the motor may be started at the bottom of the incline and then stopped and reversed at the top of the incline, or vice versa. Ordinary triple-pole, double-throw switches are to be used, conforming with the Underwriters' rules in regard to the voltage of the system.

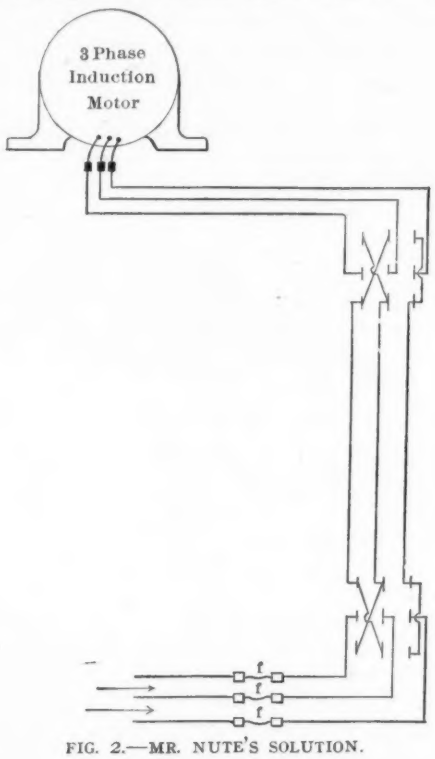


FIG. 2.—MR. NUTE'S SOLUTION.

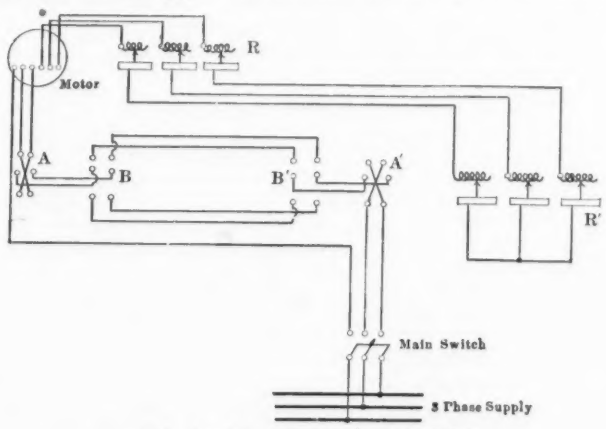


FIG. 3.—MR. WILLARD'S SOLUTION.

Woronoco, Mass. E. L. Nute.

[A similar solution was received from M. C. Turpin, Philadelphia, Pa.—Editors.]

Referring to Mr. D. C. McKeehan's inquiry for suggestions for starting a three-phase motor from either of two points, I submit the following diagram (Fig. 3). Referring to the illustration, *A* and *A'* are double-pole, double-throw reversing switches located, respectively, at the top and bottom of the in-

cline; *B* and *B'* are double-pole, double-throw switches for starting and stopping the motor; *R* and *R'* are resistances, if these be necessary, in series with the rotor windings for starting. All the switches should be closed in some position at all times and all rotor resistance cut out except when starting. If the *B* switch in either station be thrown over, the motor will start in the same direction as when last running. If both the *A* and *B* switches are thrown over the motor will start in the opposite direction. Throwing over either *B* switch will stop the motor if it is running.

SCHENECTADY, N. Y. W. W. WILLARD.

Fig. 4 herewith is submitted as a solution to Mr. McKeehan's problem in motor wiring. The problem does not state whether the motor requires a starting box or not, but inasmuch as a motor of this size may be operated without a starting box, none is shown in the diagram. *D* is a double-pole, double-throw knife switch, and *A* is a pole reverser. With these explanatory remarks the connection should be easily followed.

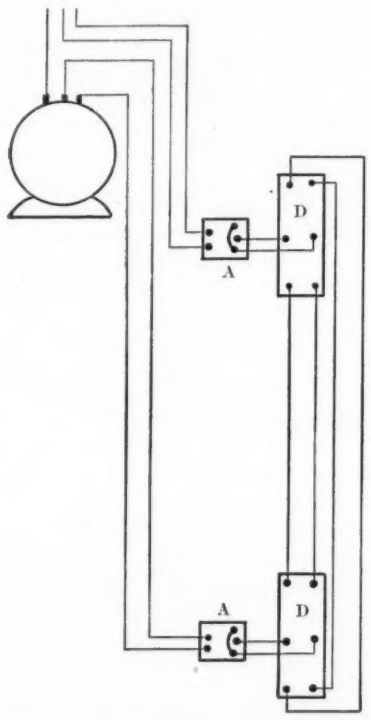
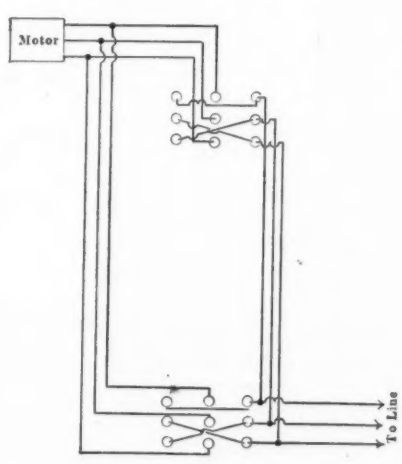


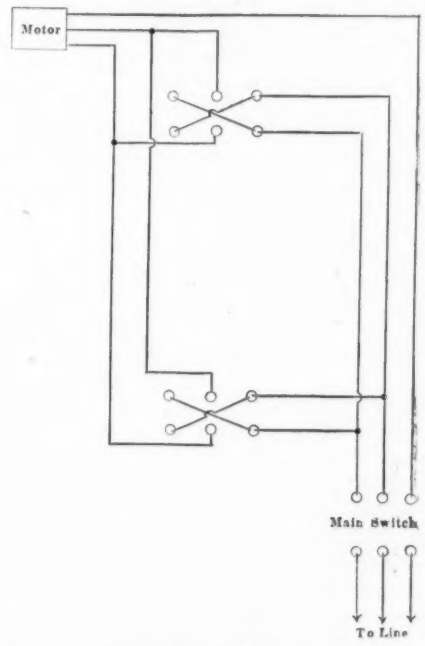
FIG. 4.—MR. YORK'S SOLUTION.

BOSTON, MASS. J. S. YORK.

I would offer the accompanying diagrams (Figs. 5 and 6) as solutions to Mr. D. C. McKeehan's problem in three-phase induction motor connections as published in the March 3 issue of the ELECTRICAL WORLD. If a main switch is not used, two three-pole, double-throw switches connected as shown in Fig. 5 will fulfill the conditions, but if a main switch is used two extra double-pole, double-throw switches may be connected as shown in Fig. 6 for control. This latter method obviates the use of one wire from one switch to the other, but requires a main switch which would probably be used in any case.

ATHENS, OHIO. F. S. DRIGGS.





FIGS. 5 AND 6.—MR. DRIGGS' SOLUTIONS.

[Although all of the foregoing solutions are operative under certain conditions, those offered by Messrs. Nute, York and Driggs are not so under certain other conditions. In Mr. Nute's solution it is impossible to start the motor from one end if the switch at the other end is open; the same is true of Mr. York's solution. Neither of the solutions offered by Mr. Driggs is foolproof, since in both instances it is an easy matter to short-circuit the line by throwing in both switches.—EDITORS.]

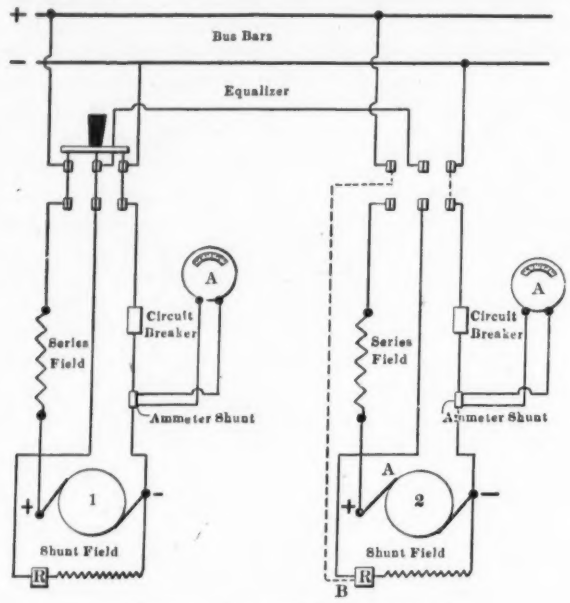
REVERSING THE POLARITY OF GENERATORS.

Referring to Mr. William Kavanagh's letter on the reversal of the polarity of a generator, in one of your recent issues, there is something I would like him to explain. He states that when a generator becomes reversed the way to remedy it is to lift the brushes off the commutator, connect the machine terminals to a live bus by means of fuses and then lower the brushes. The fuses will blow and the machine will be re-reversed in polarity. It is a mystery to me why he uses the fuses or lowers the brushes. All that is necessary is to raise the brushes and close the machine switch on the bus. This will cause a current to flow through the shunt field in the same direction as it should when the machine is running right. Another statement made by him to which I do not agree is that the burning out of a rheostat or the breaking of a field wire would reverse the polarity of a machine. In his article he speaks of a compound-wound dynamo. The opening of the shunt field in this case would simply cause the machine to run as a series machine. Of course, the voltage would drop and if it were running in multiple with other machines the machine would drop its load or motorize, but even this would not always reverse the polarity.

BROOKLYN, N. Y. F. E. DAVEY.

I was much interested in the article by Mr. Kavanagh on the reversal of the polarity of generators, a condition which is much more common with shunt-wound machines than with compound-wound machines. The method described by Mr. Jones in the February number is certainly simplicity itself and a vast improvement over the method described by Mr. Kavanagh. The method proposed by the latter may, however, be greatly simplified if only half of the brushes are raised from the commutator of generator No. 2; that is, all the brushes connected to the positive leg of the machine. The main switch may then be closed without any blowing of fuses or other pyrotechnic display, since the armature circuit is open at *A*, the brushes being raised or insulated from the commutator. Current will then flow through the shunt field circuit, and half of the current from generator No. 1 will flow through the equalizer and series coils of generator No. 2, thus giving both shunt and series excitation. After a few seconds the switch may be opened slowly so as to draw out the arc before the circuit is actually broken. This will reduce the field reaction to a minimum. The insulation may now be removed from under the positive brushes and the machine built up in the usual manner. While this method is fairly good, it has the disadvantage of being only applicable to cases where the armature is not in motion. The following method of reversing or re-reversing the polarity of a machine is quite simple and is applicable to shunt and compound-

wound machines, whether in motion or at rest. Referring to the accompanying illustration, assume that generator No. 1 is carrying the load and that generator No. 2 is reversed. If the main switches are all of the single-pole type, the negative main switch of generator No. 2 should be closed, or if the main switch is triple-pole, it may be left open and a piece of wire put across the negative clips. The field wire should now be removed from



OPERATING GENERATORS IN PARALLEL.

the binding post on the rheostat at the point marked *B*, and a wire used to connect the bus-bar side of the positive switch to this binding post. If there is a switch in the field circuit the change of connections may be made at the switch instead of at the rheostat, care being taken to make the change on the side of the switch from which the lead runs to the machine and not on the side which leads to the rheostat. If the armature is in motion the resistance in the rheostat may be cut out until the machine is generating normal voltage when the resistance may again be cut

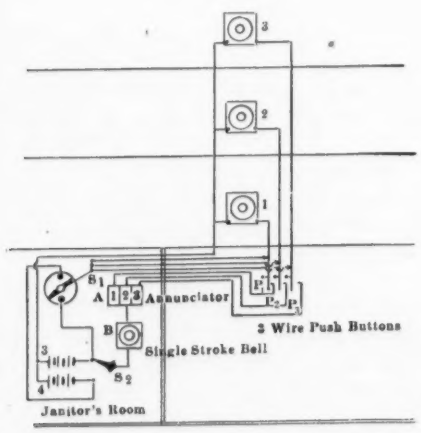


FIG. 1.—MR. DIMOCK'S SOLUTION.

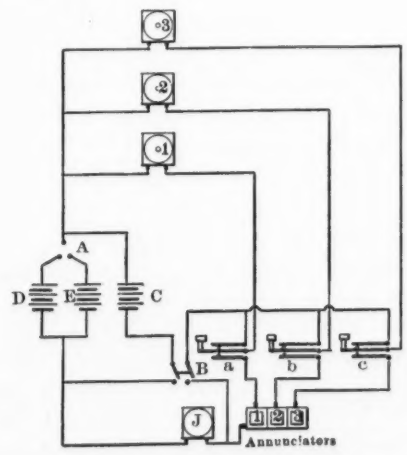


FIG. 4.—MR. WILSON'S SOLUTION.

in and the temporary wire removed from the rheostat or field switch. Replacing the proper wire and removing the temporary wire across the clips of the negative side of the main switch, the machine is ready to be built up as usual. Two or three minutes are all that is required to re-reverse a machine by this method, and the only material necessary is a screwdriver and some wire.

Niagara Falls, N. Y. E. C. Channing.

MR. DIMOCK'S PROBLEM IN APARTMENT HOUSE WIRING.

With reference to the problem in apartment house wiring submitted by me last month, I enclose herewith a diagram showing how the problem was solved. P_1, P_2 and P_3 are three-point, or open-and-break push buttons to ring bells 1, 2 and 3, respectively, and at the same time indicate on the annunciator, *A*, and ring bell *B*, which is of the single-stroke type. Switch S_1 was provided to ring all the bells simultaneously and at the same time throw extra batteries into circuit. In order to change from one battery to the other, in case one gives out, the switch, S_2, was provided.

Brooklyn, N. Y. W. K. Dimock.

Fig. 2 is submitted as a solution to Mr. Dimock's problem in apartment house wiring, which appeared in the March 3 issue. To make the required connections it is necessary to use one two-point switch and one one-point switch, which has an extra contact or clip. This clip may be made from a piece of spring brass or copper and bolted or screwed to the base of the switch, as shown in the lower portion of the diagram. Under normal conditions switch No. 2 will be on the right-hand contact, thereby placing the original battery in circuit. By tracing the current through one of the push buttons it will be found that the respective apartment bell will operate in multiple with the annunciator drop and the janitor's bell. When it is desired to throw on the extra set of batteries, switch No. 2 is placed on the left-hand contact. When all bells are to ring at once in case of fire, switch No. 1 is closed. By tracing the connections it would be evident that two batteries are now in multiple and that the janitor's bell and each apartment bell with its annunciator also operate in multiple.

Jersey City, N. J. A. E. Bauhan.

Enclosed find a solution (Fig. 3) to Mr. Dimock's problem in the Electrical World for March 3. The multi-point switch at the left selects the batteries. With the four-pole, single-throw switch open each push button when pressed causes its respective bell to ring and also the bell and annunciator in the janitor's room. With the four-pole switch closed all the bells will ring and all the annunciator drops will fall, thus indicating that the bells in all the rooms have rung. It is plain that the four-pole

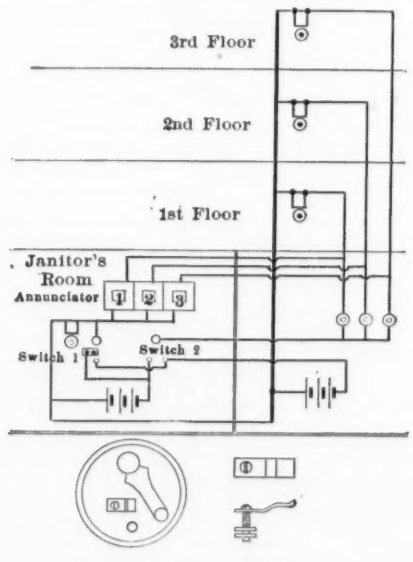


FIG. 2.—MR. BAUHAN'S SOLUTION.

switch also throws two extra batteries on the line in multiple, irrespective of the position of the multi-point switch.

Springfield, Wis. R. E. Gibbs.

I submit the enclosed drawing (Fig. 4) as my solution to Mr. Dimock's problem. *A* is a two-point switch to cut in either battery, *D* or *E*. *B* is a double-pole, single-throw switch cutting in battery *C* and closing the circuit through the bells 1, 2 and 3 in multiple when the switch is closed. This operates bell *J* in the janitor's room, but not the annunciators. The bell *J* should be of the closed circuit type; that is, it should not open the circuit while ringing and should be able to carry the excess amperage required to ring all the bells simultaneously. The push buttons,

a, *b* and *c*, are three-point, make-and-break contact switches, the upper contact being connected to a common wire to one side of switch *B*. Each bell and annunciator may be operated by its respective push button, at the same time ringing bell *J*.

CLAY CENTER, KAN. M. C. WILSON.

The accompanying sketch (Fig. 5) is submitted as a solution to Mr. Dimock's problem in bell wiring. Referring to the drawing, *A* is a lever switch, which when closed short-circuits all the contacts; *B* is a three-way switch, used for cutting in a fresh battery when one gives out; *C* is the annunciator in the janitor's room, and *D* the janitor's bell. *B'*, *B''* and *B'''* are the different batteries.

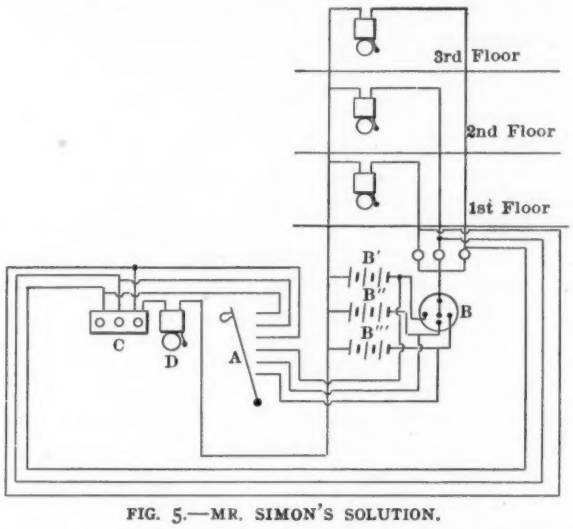


FIG. 5.—MR. SIMON'S SOLUTION.

NEW YORK CITY. M. SIMON.

Enclosed is a solution to Mr. Dimock's problem in bell wiring. Referring to Fig. 6, S^1 is a two-pole, double-throw switch and S^2 is a four-pole, single-throw switch. Starting with S^1 in the upper position, battery *a* is in circuit and by pressing button B^1 bells 1 and 1^1 with the annunciator will be thrown in parallel, and will, therefore, both ring. The same is true of each of the other circuits of two bells when the respective button is pressed. In case of fire or general alarm the four-pole switch, S^2, is closed, thereby throwing batteries *a*, *c* and *d* in circuit simultaneously, the wiring being arranged so that one battery wire will do for the entire system, while a circuit of two bells will be connected to the negative side of each battery. In the event of battery *a* giving out, the switch, S^1, would be reversed and the battery, *b*, thrown in.

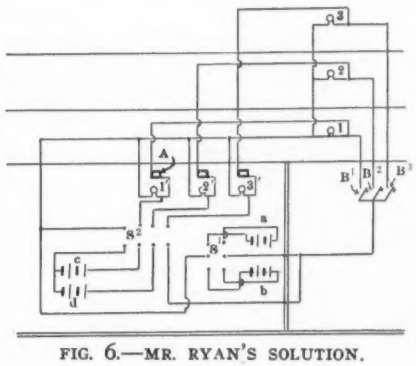


FIG. 6.—MR. RYAN'S SOLUTION.

SHAWINIGAN FALLS, P. Q. J. RYAN.

A solution to Mr. Dimock's problem in apartment house wiring is shown by Fig. 7 herewith. Referring to the diagram, *A* is the annunciator, *B* the janitor's bell, *C* a switch for throwing in different sets of batteries, *D* the alarm switch, which also throws in an extra set of batteries, and *E* is the push button. Inasmuch as four bells would be ringing at once, each bell circuit would have to have an equal resistance or the bell with the highest resistance would ring too feebly, if it rang at all.

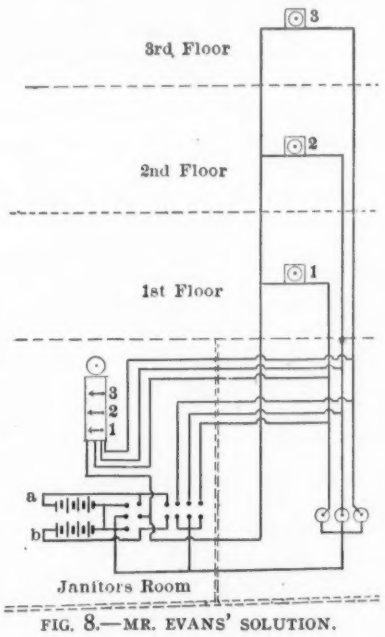


FIG. 8.—MR. EVANS' SOLUTION.

CHICAGO, ILL. W. D. LEONARD.

I submit the accompanying diagram (Fig. 8) as a possible solution to Mr. Dimock's problem in apartment house wiring. A double-pole, double-throw switch is used for changing over one battery to the other, and a four-pole, single-throw switch for ringing all the bells at once. Each bell can be rung from its respective push button as before, and the annunciator and its bell will be operated at the same time also. When the double-pole switch is closed upward battery *a* is in circuit, and when closed downward battery *b* is in circuit. When the four-pole switch is closed all the bells will ring and the two batteries will be thrown on the circuit in multiple, regardless of which one was in circuit alone.

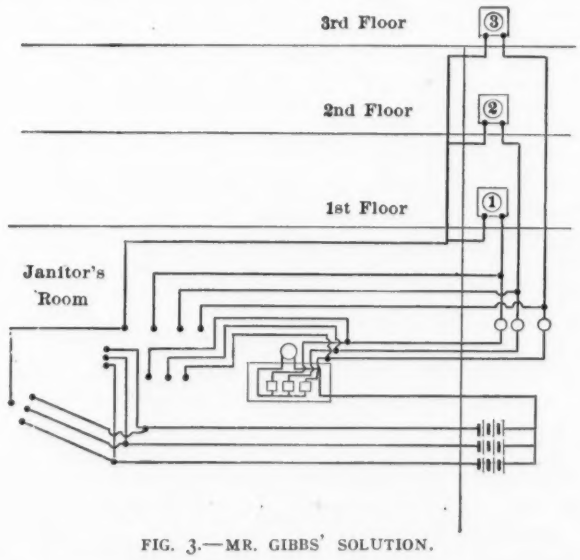


FIG. 3.—MR. GIBBS' SOLUTION.

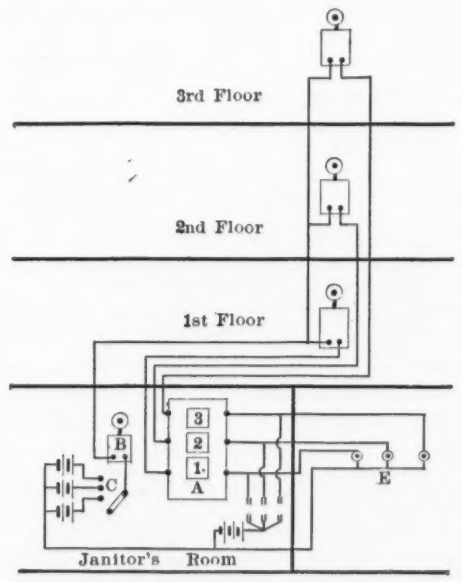


FIG. 7.—MR. LEONARD'S SOLUTION.

EATON, IND. CHESTER A. EVANS.

QUESTIONS AND ANSWERS.

How may I vary the speed of an induction motor? F. C. B.

The speed of an induction motor may be varied in two ways; either by varying the primary voltage of the motor, or by introducing variable resistance into the secondary circuit.

Kindly advise me as to the size and amount of wire generally used in the armatures of street railway motors. E. K. W.

The size of wire usually employed is No. 9 cotton-covered; the amount depends upon the size of the motor.

Can you inform me where I can obtain a B. & S. wire gauge to measure wire from No. 36 to No. 0000? M. J. C.

We do not know where you can obtain such a gauge and doubt if there are any such built. The ordinary wire gauge will measure the size of wires from No. 36 to No. 0. For sizes larger than these a micrometer is employed.

I have a 110-volt, 125-cycle, alternating-current fan motor and wish to rewind it for 60 cycles. How may I do this? M. M. H.

It is not practicable to rewind your 125-cycle motor for 60 cycles. The motor will operate on an 80-volt, 60-cycle circuit, but will only revolve at half the speed.

Where can I obtain information on "electrodeless conduction"? S. H. G.

The most complete information published on the subject that we know of is contained in a paper by A. B. Marvin in Vol. 3 of the Transactions of the American Electrochemical Society.

I have a ¾-hp. shunt-wound 220-volt motor running at 910 r.p.m. and wish to use the same as a generator. At what speed should the machine be run and what would be its output? J. C. V.

You may drive your motor as a generator at a speed somewhat higher than 910 r.p.m. and practically receive 3.25 amp. at a potential of 220 volts.

Kindly tell me what slots are to be used for the two leads of any coil of an armature having 160 commutator slots and 80 core slots, the motor being a six-pole machine and the armature having a wave winding. Which slot should be used for each side of the same coil for core spacing? D. E. R.

Use slots 1 and 54 for the two leads of the armature coil, and slots 1 and 13 for each side of the same coil for core spacing.

How is a Ruhmkorff coil used in testing the vacuum of incandescent lamps? F. A. B.

The coil is placed in operation in a darkened room and the lamp bulb is held in the hand while the base of the lamp is brought near one terminal of the coil. If the vacuum is good no effect is visible in the lamp. If, however, the vacuum is low a blue or yellow haze fills the bulb. A cracked lamp gives no glow whatever.

How can the direction of rotation of single-phase motors be reversed? S. A.

Since the direction of rotation of a single-phase motor depends on the direction in which it is started, and since, also, at starting with a phase-splitting device a motor is in reality a two-phase machine, the reversal of either phase will start the motor in the opposite direction. Therefore, to reverse the direction of rotation of the motor, interchange the leads of the starting winding.

Can polyphase alternating current be used satisfactorily on wood-working machinery in a mill having about 50 machines which are being constantly started and stopped, possibly five or more times an hour. We are figuring on changing from direct to alternating current, and would like to know if it is practicable to use three-phase induction motors. W. L.

It is perfectly feasible to use polyphase induction motors on wood-working machinery; in fact, the absence of a commutator renders the use of these motors in such places desirable.

Kindly give a good formula for filling in holes between segments of commutators. L. E. S.

Material for filling in holes between segments of commutators may be made by mixing ground mica with a binder of some good insulating and heat-resisting varnish. It is, of course, understood that substances of this kind are only useful for making temporary repairs. It will be necessary to put in an entirely new piece of mica if a satisfactory job is desired.

Of what use are tripping coils on the circuit-breakers of rotary converters? W. F. T.

These are intended to open the breakers and prevent the rotaries from racing. Without such a precaution, if two or more converters were running in parallel on the direct-current side and one should fall out of step on the alternating-current side, the other machines would commence to feed this one and drive it as a motor at a dangerous speed.

What type of motor may be used for running machinery, power being taken from street railway circuits, and what, if any, special devices are used to secure a constant speed of these motors under the excessive variation in voltage? W. A. H.

Shunt-wound motors are usually used for this purpose, and if the field cores are below magnetic saturation and the armatures have small resistances, the speed of such motors is almost constant, even though the voltage may change considerably. Motors having commutating poles will also act in the same way.

We have a three-phase motor which until recently was giving perfect satisfaction. It now refuses to start, but by pulling the belt rapidly the motor continues to rotate and gradually attains its normal speed. What is the cause of this? E. I.

One of the wires leading to your three-phase motor is broken. If a three-phase motor is running while connected to the supply circuit by three wires in the usual way, and one of these wires is broken the motor will continue to rotate and to perform its work, but if the motor is stopped it will not start up again unless assisted in the manner you describe.

Kindly explain the benefit derived from grounding the secondary circuit? Supposing the insulation between the primary and secondary coils of transformers should break through, would it not burn out the fuses on the secondary and open that circuit? I do not understand why the grounding of the secondary circuit will prevent a person from getting a shock from a lamp socket. L. W. S.

If the insulation between the primary and secondary of a transformer breaks down and the primary line insulation is defective, any one touching any live part of the installation and who is also grounded would probably be seriously injured if not killed. Even with the primary insulation intact there would be danger owing to line capacity. If the secondary is connected to ground, the chances for harm are very much lessened, since the current will not take the path of high resistance through the body of a person while a more direct path through a low-resistance wire is open. This safeguard to life in itself is sufficient justification for grounding the secondaries of transformers.

How would the primary of a 12-in. spark induction coil be wound for a 110-volt circuit to pass, say 50 amperes? If the resistance of wire to carry 50 amperes only is taken into account the number of turns grow so large that the self-induction of the winding is prohibitive. I would be obliged for any data or references on this subject. C. R. LeC.

The current ordinarily used by a coil giving a 12-in. spark on a 110-volt circuit is nearer 5 amp. than 50. In a certain coil the primary is about 15 in. long, and is wound with three layers of No. 16 double cotton-covered wire. The tubing insulating the primary and secondary windings is of ¼-in. pure rubber. The secondary is wound in sections with a silk-covered wire about No. 46. The principle applying to the design of the winding of a primary coil is that the number of turns should be a minimum and the current a maximum. The best method is to make a trial coil of few turns and then with a rheostat in circuit pass varying currents until the best effect is produced. Knowing the number of amperes and the turns of the coil, the ampere-turns will be determined. The final size of wire will then be fixed by the space available and the heating of the wire. A single layer of heavy wire would be better than a double layer of a lighter wire. Instead of putting in the primary the resistance necessary to cut down the current from the 110-volt circuit, this resistance should be placed exterior to the coil. Owing to the nature of the magnetic circuit and the many variables entering, the primary of an induction coil does not admit of calculation, and should be determined experimentally for every type.

CENTRAL STATION SALE OF CURRENT

THE CENTRAL STATION SOLICITOR.

The growing movement all over the country towards the organization of business getting developments by central stations is resulting in the rapid development of a class of salesmen almost unknown a few years ago outside of the largest cities, namely the solicitor for central station business. At present the demand for talent of this kind seems to be decidedly in excess of the supply. Much has been said about the qualities which go to make up a successful solicitor for a central station company. Stated briefly, they simmer down to these: Ability as a salesman and a knowledge of the things to be sold. While the most successful salesmen like the most successful members of any other calling are born rather than made, we find tolerably successful salesmen, who have merely through training become proficient. We do not propose here to deal with the art of salesmanship, which is deservedly receiving an increasing amount of attention these days, but rather to point out some of the equipment which a central station solicitor must have in addition to the qualities of a salesman when he goes out to get business for central stations.

It may not be necessary for him to be posted on all the technical details of the appliance he is trying to place or installations he is trying to secure, but he should be thoroughly posted as to their advantages compared with what the customer uses at present. As to how much engineering and technical ability is required depends much on the kind of work for which he is soliciting. In power work, where it is a question of supplanting some other prime mover with electric motors, some engineering knowledge and ability to plan a new installation may be necessary. For this class of work in the smaller cities usually the manager himself is the only one fitted. In soliciting for electrical advertising by means of signs and window display or decorative lighting, the ability to help the customer originate schemes is of considerable value. In soliciting for residence and store lighting the solicitor is usually the customer's adviser as to the proper installation of lights to secure the best results. For this work a knowledge of illuminating engineering, or at least a knowledge of when to call for help of this kind from the manager or engineer of the company, is of first importance. Some specialist in this work should be included in the business organization of every large company and the more of this knowledge that can be acquired by those connected with the smaller companies the better. One large company employs the services of a consulting illuminating engineer outside of its organization to advise with and direct the study of a number of engineers in its new business department which specialize in this work.

In soliciting for various appliances which use electric current the first essential is an intimate knowledge of the advantages of the appliance which the solicitor is trying to place. In such cases general talk is of little avail. The solicitor must have at his fingers' ends the special points in which the electric device excels all others. It is time worse than wasted for a solicitor to attempt to place devices of which he has no knowledge unless he is willing to frankly admit to the customer that he has no knowledge and is willing to leave the entire matter with the customer. Some devices have enough merit to be sold in this way, but the chances are much better for placing the device if the customer has well impressed upon him its advantages and has created in his mind a dissatisfaction with the old inconvenient methods.

A pithy remark dropped by one of the speakers at the last Northwestern Convention was to the effect that a solicitor who is a new man or a stranger in a town will go into the town and get business which the central station manager who has been there for years would never dream of getting. There is undoubtedly a great deal of truth in this statement. A solicitor who is new in a town knows none of the objections which have been raised by various possible customers to installing motors in place of steam engines or to supplanting gas or kerosene by electric light. He simply forges ahead in blissful ignorance of the objections the manager of the plant has previously run against, and if armed with a salesman's ability and enthusiasm will land many a customer that the manager who has been on the ground for years will despair of. It is furthermore frequently the case that qualities which go to make a good central station manager are not combined with first-class ability as a salesman. A salesman must necessarily to a large extent be of the type of man known as a "special pleader." A successful manager is apt to have more of a judicial and executive mind which considers and weighs all sides of questions which come up daily for decision. Another point which frequently handicaps any man who has been in a town for a number of years is that opportunities for the use of central station service are usually not as apparent to one who has been walking the streets daily as to a stranger. He will go by opportunities daily without a thought of the possibilities because things which become familiar to us soon cease to receive thought or attention. The moral of all this is that it is a good thing to bring in some outside talent in the soliciting end of the business occasionally, and that it is not always safe for the manager to assume that he has worked the business for all that is in it.

CO-OPERATIVE WORTH OF SALESMEN WITH AND WITHOUT ADVERTISING.

If your salesman spends all his working hours hunting through his district for people who are possibly interested in electric light, you will often find him an exceedingly inefficient piece of apparatus, although he may personally be an able salesman. The reason for this seems obvious. Most of his time is spent in hunting for interviews, and the time is not consumed in the most useful manner, namely, face to face with prospective customers. If he could spend all his hours in laying the merits of electricity before the prospect, he would, of course, be from five to ten times as efficient. If the probable customers could be lined up and admitted to the salesman's office, one by one, we would have ideal conditions, but until the elements underlying commercial conditions are turned topsy-turvy, this roseate opportunity is not for our friend the electric light salesman or solicitor.

The best way of supplementing his efforts is by an intelligent method of following up every possible prospect by the direct form of mail solicitation.

If the amount of money to be spent is small and local conditions do not render necessary advertising in the local press, then by all means, throw all of the appropriation to supplementing the efforts of the salesman. Try to lighten his load, and (paradoxically) increase his efficiency by working up the prospects for him, and wherever possible, securing appointments for a definite day and hour to save the salesman's time. Even where this cannot be accomplished, the general education and enlightening of the mass by campaigns directed against the possible users, will surely prove potent, by "warming up" the prospective consumer, and getting him into a receptive mood when the solicitor calls upon him.

THE PAYMENT OF CENTRAL STATION SOLICITORS.

Owing to the fact that numerous central station companies are now starting new business departments and others are enlarging those previously established there seems to be considerable interest manifested in the subject of the basis which shall be adopted for the payment of central station solicitors. A description of some of the methods of large and small companies is, therefore, of interest.

We have already given an account of the organization for soliciting business of the Denver Gas & Electric Company, which maintains for its gas and electric business a force of about forty solicitors. We are indebted to Mr. C. N. Stannard, contract agent

of that company, who has supervision of solicitors for further details relating to the plan of paying solicitors in Denver:

All business secured comes under some heading of the following classification:

Class	A	Additional consumption, either gas or electric (present consumers)	5	points
"	B	New contracts, gas or electric, where service is not previously in use	3	points
"	BB	Industrial fuel gas	7	points
"	C	Replacing service or equipment for old or new party where formerly in use	1½	points
"	D	Present users, changed to other address	1	points
"	E	Outlining on buildings	6	points
"	F	Outlining on present signs where flat against the building	5½	points
"	G	Outlining on present projecting signs	5	points

As an illustration of the application of this schedule, take, for instance, class A, additional consumption. Let us assume that a customer for illuminating gas is persuaded to put in a gas range, the estimated consumption of which is $20 per year. Figured at 5 points, the representative is entitled to 100 points for securing this business. All other classifications are figured similarly. A record is kept of the points secured by each representative, and at the end of the month it is determined what percentage each representative is entitled to as compared with the total business secured. As an illustration, let us assume that for the month of December there were 60,000 points of estimated business secured. We will further assume that one representative secured 10 per cent of that amount, or 6,000 points, that for the month of January the company had an increased gross revenue of $15,000, due to natural causes and to the work done by the representatives during the month of December. If it is agreed by the company that the representatives are to have 5 per cent of the increased gross revenue as a bonus, it gives them $750 of bonus money, to be divided among them according to their percentage of business secured. Thus the representative above mentioned, having secured 10 per cent of the business in December, would be entitled to 10 per cent of the bonus money secured in January, namely, $75, which would be paid him February 5. In addition to the bonus, representatives may be paid a flat salary of, say, $60 per month. Thus this man would receive for his December work a salary of $60 plus a bonus of $75, or a total of $135.

It will be observed that the work and business secured by the representatives in the month of December ought to show in the company's increased revenue during the following month of January, and between the first and fifth of February from the books the amount of increased revenue is determined. Therefore, by the fifth of February a settlement can be made as outlined.

The Brice Gas & Electric Company, of Mason City, Iowa, is a good example of a small central station company which is pushing actively for business and where the conditions are radically different from a large city. Mr. A. W. Zahm, general manager, writes as follows about the experience there:

"We have tried a number of schemes with our solicitors. Year before last we paid them $10 per week and $1 premium for every customer secured in excess of 20 per month. At this rate we could not secure a thoroughly first-class solicitor, as they did not care to take a chance at so small a salary, and this method was not very successful. Last year we engaged two solicitors—a man and a woman—at a salary of $75 per month without commission. They were both local people, well and favorably known, and we found this the most successful method. Aside from securing a large volume of new business, they induced a number of their friends to install services that could not have been secured in any other way. We are satisfied that this is the best system and we expect to follow it the coming year. We only employ solicitors for seven months, commencing April 1, and discontinuing October 1."

In Chicago the Chicago Edison Company and the Commonwealth Electric Company maintain a force of about forty solicitors. Most of these are on a salary, though a few are on commission.

At Kenosha, Wis., the solicitors are on a salary.

Some stations employ a professional solicitor for a term of several months, paying a salary and commission.

Central Station Business-Getting Methods in New Orleans.

Long before the recent general awakening to the importance of business-getting organization by central stations, the Electrical Department of the New Orleans Railway & Light Company had thoroughly systematized this branch of its business. As of particular interest through being a system which has been of all along natural lines, and not the mere application of a scheme worked out on paper, we give below a brief account of the various details.

GENERAL ORGANIZATION.

All solicitors and other employes connected with the contracting department report directly to the contracting agent, who is

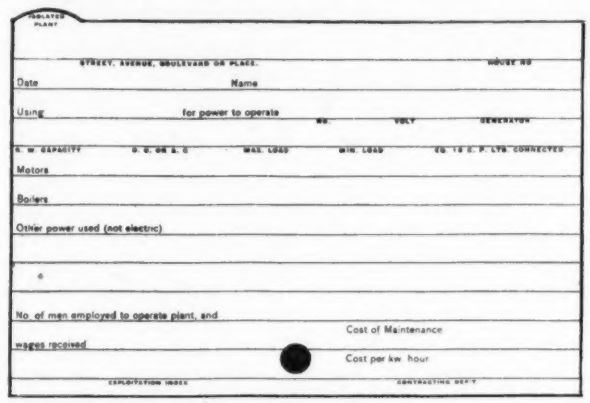


FIG. 1.—ISOLATED PLANT CARD.

responsible for their acts, and whose duty it is to see that all possible efforts are put forth by his corps of men in the direction of following up and securing new business. He also, up to a certain point, settles questions of rates, guarantees, deposits, line extensions and many other minor matters connected with the wishes and requirements of the public. In the office are two trained assistants, whose knowledge of the business includes information as to the method of conducting the meter and auditing departments, together with a general idea as to service connections, location of pole lines, and also character of service which can be furnished at different points throughout the city. On the outside one or two of the solicitors whose aptness fits them for the duty, are picked out to attend to special work, or in other words to act as special assistants to the head of the department. One of these is entrusted with looking after the com-

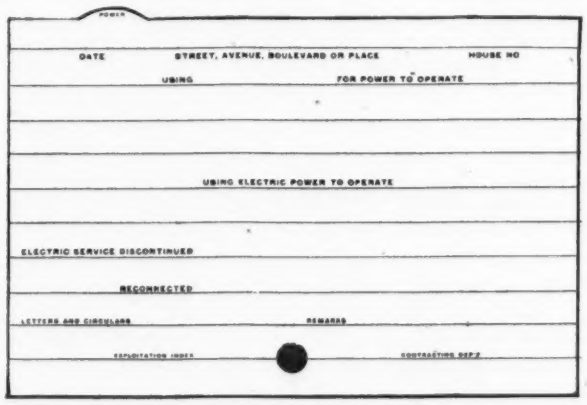


FIG. 2.—POWER CARD.

plaints on bills, which duty requires a man with some technical knowledge together with tact and patience.

An inspector is also connected with the department, as his services in the way of looking after flat rate connections, taking volt reading, renewing lamps, etc., are in constant demand.

The regular solicitors work along lines which will be taken up further on, and their reports as to each day's work is handed in to the contracting agent and checked up each morning.

METHODS OF SECURING NEW BUSINESS.

In securing new business, first and most important are personal solicitation and house-to-house canvass, together with following up of all clues and hints, many of which are received each day at headquarters, some by mail, some by telephone and still others through friendly wiremen and contractors. In the power branch of the business a customer is often secured by inducing him to visit and examine the plant of some one in the same line of business, whose machines or other devices are being operated by electricity, and where the service is giving satisfaction.

Judicious advertising is employed, together with a continual circularizing of a specially prepared list. Special care is given

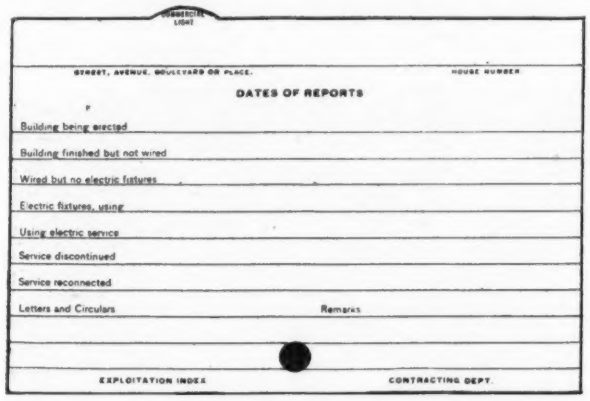


FIG. 3.—COMMERCIAL LIGHT CARD.

to sending out a carefully drawn up letter to every one who obtains a building permit, with which is enclosed a stamped addressed return postal card, in order to encourage the prospective customer to send an inquiry as to the service.

METHOD OF RETAINING BUSINESS.

All complaints are filed with the contracting department and are given special attention by one of the solicitors. If it is a request for an examination of a meter, the matter is first referred to the engineering department for a "test report," when this is returned with the information requested, a representative makes a personal call and goes carefully into the matter of the result of the examination of the meter.

Whenever a notice is received requesting a discontinuance of service, a representative calls in order to find out if any dissatis-

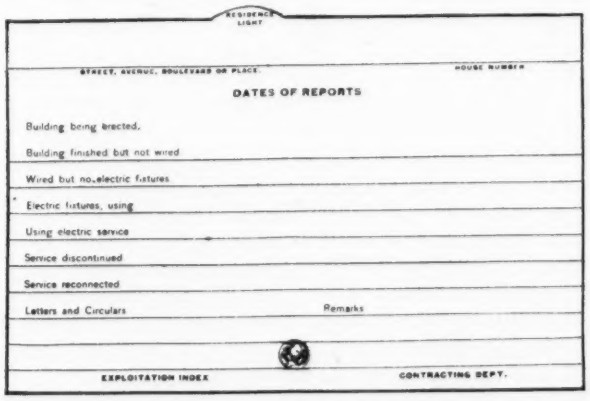


FIG. 4.—RESIDENCE LIGHT CARD.

faction exists, the idea being to clear up any difference which may have arisen. This attention often results in holding business which would otherwise be lost, or gives the solicitor an opportunity to renew a contract from new occupants of the premises.

OFFICE SYSTEM.

The names of all new applicants for electric service are kept on file in the office of the contracting department, and as soon as the different requirements are met with an installation order is issued in duplicate. The original of this order is sent to the meter department, which sends a memorandum to the engineering and auditing departments for their records; the duplicate copy is kept by the contracting department in book form and a daily report made out in triplicate, a copy being sent to the president, vice-president and contracting agent, respectively. In this way increase or decrease in installations is readily kept track of, and good work of the solicitors brought to light.

At the end of each week all new contracts secured during that period are passed to the contracting agent, and after being signed by him are finally approved by the vice-president, each contract being accompanied by a rate card with data of the installation, date of contract, deposit, etc.; after being signed by the above-mentioned officers it is filed with the auditing department so as to be readily accessible to the bill clerk.

All notices to discontinue service are received and issued by the contracting department and are disposed of in the same manner as the installation order; these are issued in triplicate form, the triplicates being sent immediately to the auditing department. The reason for this is to enable a flat-rate customer to receive his bill up to date and assure him that he will not be charged for current after the date on which he ordered the service discontinued.

"Insurance approvals" of wiring installations are kept in a card system, which constitutes a very valuable record, as it is run by street locations instead of alphabetically and is a record which is referred to a great many times during the day.

Prospective business is also followed up by means of a card list, there being a special card for each class of business, such as commercial, power, residence and isolated plant. The obverse of a card from each of these files is shown herewith. The cards are in different colors, and on the reverse are spaces for the name of customer, date of application and remarks.

We are indebted to Mr. W. E. Clement, contracting agent of the Electrical Department of the New Orleans Railway & Light Company, for information on which the above account is based.

An Active Campaign for Business at Dayton, Ohio.

THE OPPORTUNITY.

UNDOUBTEDLY one of the most vigorous and enthusiastic campaigns for new business now being carried on by any central station company in the United States is that of the Dayton Lighting Company, at Dayton, Ohio. The company realizes that it has before it an opportunity such as probably does not exist in any other city of the size in the United States. At the time the present management took hold, January 1, 1905, there was in Dayton, a city of about 100,000 inhabitants, no electric lighting distribution system outside of the down-town business district. Such a condition of affairs is truly remarkable. It is an extreme case of how far central station companies sometimes fall short of developing the territories which naturally belong to them. The company is now extending an alternating current distribution system to all parts of the city and is pushing very actively for all classes of business, not only in the hitherto unworked outlying sections where there is a magnificent opportunity for electric lighting of residences and supplying power to manufacturers, but also in the down-town district where sign and display lighting and the displacement of isolated plants offer great opportunities.

THE SOLICITING ORGANIZATION.

The company's soliciting force consists of one chief solicitor assisted by ten district or ward solicitors. There is also one man who devotes his entire time to testing of steam plants, gas engine plants and the like, in places where the Dayton Lighting Company is figuring on supplying the power. The general manager of the company, Mr. F. M. Tait, is not only an engineer, but also an energetic business manager, with the ability to impart snap and enthusiasm to the members of his staff. In fact, there is no place in the company's organization for men who cannot be inspired with some of this enthusiasm. Just as in the operating departments of the company, men

must be always vigilant, wide-awake, and ready to respond to instant calls, so in the soliciting department men are employed who are always awake to opportunities to put in electric service and talk electricity and its conveniences. Mr. Tait, the general manager, meets with the solicitors every morning from 8 to 8.30 that they may talk over questions which daily arise, and as they express it in Dayton, "to get filled up with enthusiasm for another day."

Mr. J. G. Barrett, chief of solicitors, is one who demonstrated his ability in this kind of work at Chicago, and later at New Albany, Ind., before going to Dayton. Besides having charge of the soliciting force, he acts as a kind of specialist on power for the new business department, and to help the district solicitors on especially difficult or important cases. Besides the chief solicitor, the ten district solicitors and one man working on isolated plant tests, there is one clerk in this department, who keeps all the records, and has ready for each solicitor every morning a memorandum of any requests for calls which may have come in during the previous day. Solicitors are paid a salary, which is increased according to the returns which they bring in, although no commission system has been worked out. Each solicitor is assigned to one ward of the city.

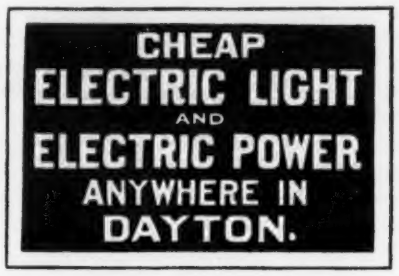


FIG. 1.—COPYRIGHTED SIGN.

Solicitors are all young men picked up from other lines of work in Dayton without previous electrical experience. Some of the best were formerly salesmen in other lines. Men selected must be of good character, entirely temperate, with clean records and with plenty of snap and vim.

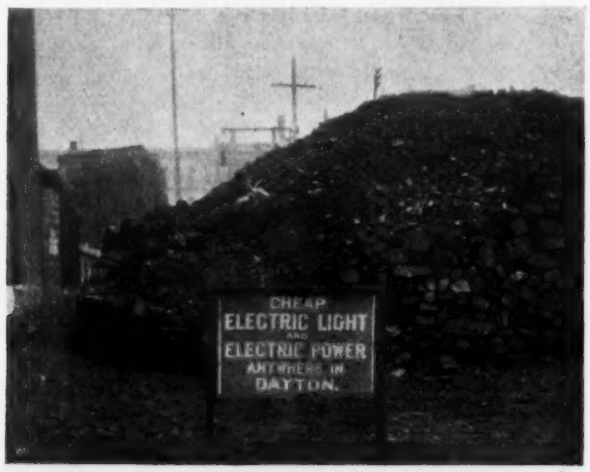


FIG. 2.—SIGN ON COAL PILE OPPOSITE CENTRAL STATION.

SIGNS AND TRADE MARKS.

While the company's solicitors have had the advantage of working in an almost undeveloped territory, they have also had the disadvantage that the general public in Dayton was not familiar with the advantages of electric service. Early in the campaign, a copyrighted sign was adopted, "Cheap Electric Light and Electric Power Anywhere in Dayton." This appears on the company's letter heads, envelopes, signs and wagons, in the form shown in Fig. 1, which is a reproduction from one of the company's large mailing envelopes. Fig. 2 shows the sign on the company's coal storage lot across the street from the power station. This style of sign is to be seen all over Dayton on vacant lots and other good advertising places.

PORTABLE ELECTRIC SIGN.

The company plans soon to have a portable electric flashed sign which can be hung on poles in different parts of the city to advertise the Dayton Lighting Company at night. Another sign which is used on all new buildings under construction for which the Dayton Lighting Company supplies power and light, is shown in Fig. 3. This particular sign, Fig. 3, was photographed on an old church building in the down-town district where a food show was held March 5 to 17. The Dayton Lighting Company had an exhibit at this show with several solicitors always in attendance. Next to this exhibit, baking was being done by another exhibitor by means of electric current and electric cooking dishes were being used by demonstrators of various food suppliers all over the building. Taken altogether, Dayton electric service was very prominent at the show.

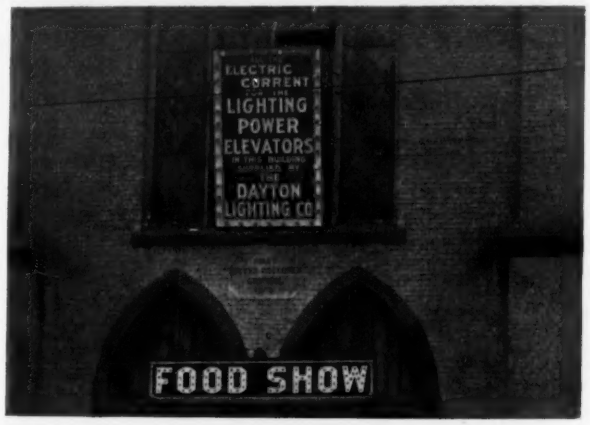


FIG. 3.—SIGN USED ON NEW BUILDINGS.

MONTHLY MAGAZINE.

A monthly magazine entitled *Dayton Electricity*, is published. Of this magazine, 5,000 copies are printed each month. These are circulated by mail. Fifteen thousand copies each month were formerly printed and distributed, but the loss and waste in distribution was found to be so great that it was thought best to print fewer copies and mail them where they would probably do some good.

NEWSPAPER ADVERTISING.

The company arranges its advertising among the Dayton papers so that there is an advertisement in one paper every morning and every evening. It advertises every other morning in two morning papers and every other evening in two evening papers. The usual space occupied is five inches, double column. Frequent illustrated articles in the daily papers tell of the company's construction work or of new motor installations.

TO PUSH HEATING DEVICES.

A campaign for the pushing of electric heating devices is about to be begun. Flatirons are being sold to customers at the wholesale cost to the company. The plan is to send out solicitors with a load of flatirons, chafing dishes and heating pads, leaving them at residences on two weeks' trial.

HOUSE WIRING.

The company does not do interior wiring, leaving this to Dayton contractors who are experiencing a prosperity never before known in Dayton, on account of the large amount of new work.

On the back cover page of the *Dayton Electricity*, is published free of charge a directory of reliable contractors, supply dealers and sign builders for the benefit of the company's present and prospective customers.

The company endeavors to have every house wired as far

as possible with a heating circuit to the kitchen and dining-room independent of the lighting service. This can be heavy enough to carry any heating device desired without going over the 660-watt limitation of lighting circuits. It can also be used for operating the motor in the basement if necessary. It is hoped to develop some motor-driven washing machine business.

ATTENTION TO DETAILS.

The company makes a great point of responding immediately, not only to requests for electric service, or requests for solicitors to call, but also to trouble calls from customers. From the general manager down, great stress is laid on prompt and courteous treatment of the public and of seeing that electric service is satisfactory. The door of the general manager's office leading into the general office is always open, and there is no red tape when any customer wishes to step in and talk with the general manager.

A close watch is kept on gas engines and when they break down or give trouble to the owner, as they are sure to do sooner or later, a solicitor is promptly on the ground telling of the convenience and reliability of electric motors.

THE RESULTS.

At the close of 1904, the company had about as many meters installed as a good enterprising central station company should have in a town of 10,000 inhabitants, although Dayton is ten times that size. By virtue of pushing the business and extending into residence territory, the number of meters was increased 300 per cent. during the year 1905, and, of course, this is only a beginning.

Besides increasing the number of meters connected 300 per cent. during the first year of this campaign, seventeen isolated plants have been displaced. The connected light load has been increased from 22,000 to 37,000 50-watt lamps and 1,500 hp of new motors connected, to say nothing of 120 new electric signs.

Central Station Advertising.

By Converse D. Marsh.

Probably every central station in the United States realizes to the full that additional business means not simply better profits, but—to coin a term—accelerated profits. As a general proposition it can be stated that the additional fixed charges do not increase at the same ratio as do the gross profits, and in consequence the net profits per unit of energy sold are larger as the business grows larger. While this statement is true of any manufacturing business, it is particularly true in the manufacture of electricity. Moreover, there is a crying need in many of the smaller stations for a flatter peak and longer hours of use by consumers.

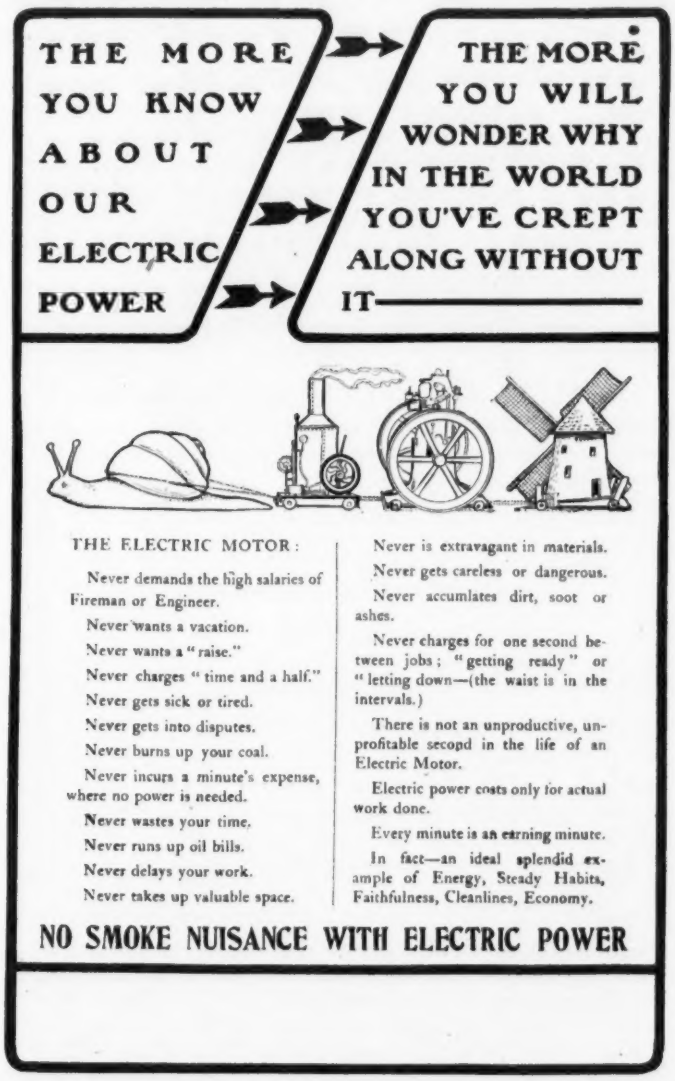
While advertising is a potent force for bringing about better conditions it should be buttressed and strengthened by direct solicitation with the best salesmen obtainable. Properly combined they can work wonders,—disunited neither will have one-half of the force of the two combined.

Not the least of the influences which have kept many stations in the rear is the lack of competition. Recently a central station manager in conversation with the sales manager for an electric lamp manufacturer spoke despondently of the keen competition of gas in his city. The latter listened with a scarcely suppressed smile, and when the central station man had finished spoke as follows:

"I don't believe you or central station managers in general really know what competition means. In my business I go out to solicit a customer and there are sometimes as many as from six to ten other lamp men in the same day to see the customer. That's the kind of competition that keeps me alive and awake. I am thinking how I can get the best of the other fellow night and day. But you, on the contrary, have no such competition to worry about, and as a consequence you don't stir up as much new business as though you had competition to worry you and keep you not just thinking, but keenly thinking and pushing to keep aggressively alive."

In order that a central station may get the best results for any single line of business-getting, there should be employed *every* method that will help in getting business.

First, there should be solicitors. Second, the solicitors' efforts should be backed up by direct mail solicitation. Third, there should be, if it is possible, an exhibition, or show room, easy of access, on the ground floor on a principal street. Fourth, illuminating bill board advertising should be used. It is a concrete example to others of sign advertising. Fifth, electric signs should be used as an illustration to merchants whom you


THE MORE YOU KNOW ABOUT OUR ELECTRIC POWER
THE MORE YOU WILL WONDER WHY IN THE WORLD YOU'VE CREPT ALONG WITHOUT IT
THE ELECTRIC MOTOR:
Never demands the high salaries of Fireman or Engineer.
Never wants a vacation.
Never wants a "raise."
Never charges "time and a half."
Never gets sick or tired.
Never gets into disputes.
Never burns up your coal.
Never incurs a minute's expense, where no power is needed.
Never wastes your time.
Never runs up oil bills.
Never delays your work.
Never takes up valuable space.
Never is extravagant in materials.
Never gets careless or dangerous.
Never accumulates dirt, soot or ashes.
Never charges for one second between jobs; "getting ready" or "letting down—(the waist is in the intervals.)
There is not an unproductive, unprofitable second in the life of an Electric Motor.
Electric power costs only for actual work done.
Every minute is an earning minute.
In fact—an ideal splendid example of Energy, Steady Habits, Faithfulness, Cleanliness, Economy.
NO SMOKE NUISANCE WITH ELECTRIC POWER

are soliciting for just such work. Sixth, newspaper advertising can be employed.

If newspaper advertising is used, do not consider that you simply have space to fill and then put anything in that space, but try to make every word deliberately count. Do not try to fill any given amount of space with words, but express your idea and *then stop*. You must remember, however, that brevity, while the soul of wit, is not necessarily the essence of an advertisement. Disconnected facts can be put so coldly that they fall of intent. Make your newspaper advertising advance the common-sense every-day arguments that your salesman would use. Don't make a newspaper advertisement too formal, nor yet adopt sensational or "circus" methods.

One good plan is to try to see after writing if there are any words or sentences which could be eliminated without injuring the strength of your argument.

Remember that humorous advertising is a dangerous thing. You may set the reader to laughing, but he is liable to miss your point if you set him to laughing, or take your serious argument humorously. It is a dangerous thing to start your reader in the wrong direction.

Remember, too, that if you yourself go in to buy, say, a suit of clothes, there is nothing funny about it. It is a serious thing for you—you are going to spend your money and you don't joke while you are spending it.

Secure attention by forceful English and don't be afraid to "loosen" up and talk. If you talk to the point, and give strong arguments, you can get attention where you cannot secure it by the *outré* methods.

There should be just as much hard-headed logic in getting up a newspaper advertisement—or any other kind of advertisement—as you would employ in talking to a man yourself, in trying to induce him to do what you wanted him to do. There are no talismanic touches that you can safely indulge in.

And remember, that not one advertisement, or two advertisements are going to do the work. It is going to take a long procession of them to move any number of people out of the beaten track to which they have been accustomed in the past.

If goods could be profitably sold by just taking a flier now and then in the public press, every square foot of territory in the United States would be dotted with millionaires as thickly as they have been strewn around Pittsburg since the organization of United States Steel.

It takes times, patience and money to achieve success in any kind of advertising, and this is particularly true of general publicity.

The accompanying cut is an example of an advertisement for electric power suitable for any electric lighting company. As here reproduced, it is only of about one-half the size for most effective appearance.

Good Breeding in Advertising.

By Frank B. Rae, Jr.

The central station fraternity is entering upon an era of advertising. While the art of advertising has outgrown its swaddling-clothes and attained in certain quarters the dignity of a profession, so far as we in the electrical field are concerned it is still in an embryonic state. We are experimenting. We are feeling our way. We are casting about for knowledge.

Advertising, it is well agreed by those who have studied and practiced it as an art and profession, embraces every phase of our dealing and expression with and toward the public.

Employes who represent us to the public advertise us well or ill according to their discretion, tact and personality. It is good advertising to have courteous, upright employes.

Our place of business may well be termed advertising, influencing the public for or against us according as it is well-kept, attractive and convenient. This phase of the advertising problem is seen most fully developed in metropolitan department stores, where every convenience is placed at the free disposal of the public, whether a customer or not. It is finding expression among lighting companies in the display rooms which are now considered so essential to the progressive contract department. Such rooms are good advertising.

An honest and "above-board" policy, both to press and public, is a very vital form of advertising. Conciliation in the face of public complaint and equanimity towards newspaper clamor will bring their reward in time. Such policy is good advertising.

Finally, printed announcements, cards, folders, letters, posters and sign-boards are advertising. It is these which engross us just now.

If it be true, as the masters of advertising agree, that courtesy upon the part of employes, attractiveness in our places of business, and dignity and honesty of policy are elements in good advertising, it must follow that these same elements should pervade the more generally accepted forms of advertising—in other words, that our announcements, circulars, etc., should be courteous, attractive, dignified and honest. These, it seems, are the fundamental elements. But there are other elements and ways of combining these elements, which add to or take from the printed advertisements.

An advertisement must attract attention—stand out from the great mass of printed mediocrity—to secure a second glance. It must bear a forceful or catchy headline to rivet attention and awaken interest. It must be written in crisp, sparkling, clever style to insure a thorough reading. It must present our proposition logically and convincingly, soliciting an immediate favorable answer.

These are secondary elements, if you prefer, but essential to successful advertising. They are the structure erected upon foundation principles. To carry the simile further, the foundation principles are a matter solely of business engineering: the structure, of engineering plus art. A structure with false foundations soon topples of its own weight: a structure without art is a public eyesore.

It is here that the advertising man enters—to supply the art, graphic and literary.

To most of us, the advertising man is a somewhat incomprehensible being. Sometimes he is a youth with a diploma which certifies that he has paid forty dollars to a correspondence school. Again he may be the representative of a large firm. In either case he is likely to give the impression that he wishes to run our business for us, whereas we feel able and competent to continue without him. As evidence of his ability, he presents certain specimens of his craft. Study them well, but study the man even more. He is offering you something you need—the art of advertising. It is for you to decide whether this art is of a class and quality worthy of your business—whether it is *well bred.*

We have said that a good advertisement must attract attention—but the right sort of attention. If attention, *per se,* were paramount, a clown in his motley, going about the streets with our business card tacked to his back, would suffice. But the object of attracting attention is to keep our printed matter from going unread into the waste basket. Unfavorable attention will only accelerate its speed to its ultimate resting-place.

It is admitted that a good advertisement must bear a forceful or catchy headline. But there are kinds and degrees of forcefulness and catchiness. The yellow journals run "forceful" headlines. They are sometimes printed from types of six-inch face, in scarlet ink. Somehow, well-bred people do not approve of them, nor of similar endeavors applied to advertising.

No one denies that a good advertisement must be written in crisp, sparkling and clever style. But abbreviations do not constitute crispness, nor does a habit of taking liberties with our mother tongue indicate cleverness. Sparkling English is first distinguished by its clearness and purity—it gains nothing by defilement in the gutter. The advertising writer who fails here, fails absolutely. He who cannot sustain interest in his argument without recourse to the vernacular, is a poor word-monger indeed. That he must needs shock the reader into reading, is evidence of his inability to hold attention by legitimate use of words and adherence to accepted customs in punctuation.

Finally, a good advertisement must present the proposition logically, and secure a favorable answer. This is the ultimate test of advertising, as of salesmanship. We judge the ad-man's ability to do this for us by the manner in which he does it for himself. Is he logical? Is he convincing? Does he impel us to answer him immediately and favorably? And if employed to handle our advertising, can he be depended upon to convince that class of the public with which we deal—the better class—of the substantial merits of central station service?

These are the questions that confront the electric light fraternity in the preparation of their printed advertising matter and their employment of an advertising man. Primarily they are questions of good breeding—good breeding in advertising.

Central Station Advertising

The preparation of central station newspaper advertisements not alone commands the attention of the so-called "experts" in the field, but is apparently enlisting the energy of other advertising specialists who have caught the point that such advertising, in order to arrest public notice, need not be technical, but should preferably be otherwise. Mr. B. Alten Block, of New York City, in sending out a broad sheet of nearly a score of central station "ads" remarks that it requires no more elaborate equipment of brain power to push electricity than it does any other commodity, such as gas or groceries, but that steady advertising all the time is the winning quality if the work be intelligently done. As he remarks, "All it requires is common-sense talk, attractively illustrated and lucidly presented; to be followed up by intelligent solicitation." We reproduce herewith, as an exemplar of Mr. Block's ideas and methods, one of his advertisements bringing out rather effectively the value of the porch light, the same idea being elaborated in one or two other attempts. The advertisements deal with the various subjects of signs, fans, electric heaters, electric motors, house lighting, show-window lighting, etc., and are avowedly addressed to the attention of the masses. These advertisements are intended to be used as complete appeals, or the name of the company can be added with other matter in regular display type by the local newspaper office.

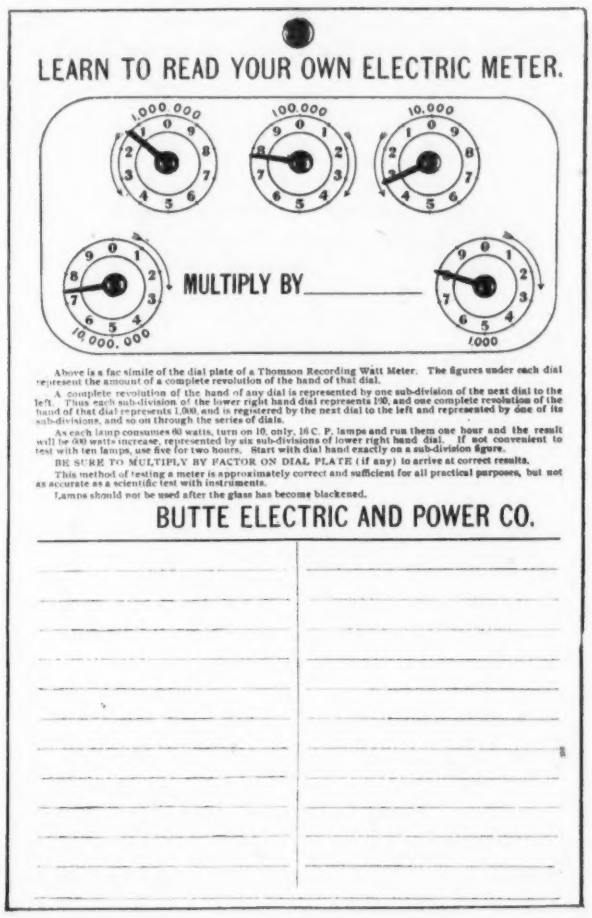
Meter Reading.

The Butte, Mont., Electric & Power Company supplies to all of its electric light and power customers a card, reproduced in the accompanying illustration, to enable them to check their bills for electric service. A heavy cardboard is used having an eye for hanging the card up on the wall. As will be seen, the five dials of a meter are reproduced on the card, with movable metallic pointers secured by eyelets. It will be noted that the card contains blank lines for recording the monthly readings. The size of the card is 5½ x 8 in. As in the reproduction the instructions on the card are illegible, they are reprinted below.

"Above is a fac-simile of the dial plate of a Thomson recording wattmeter. The figures under each dial represent the amount of a complete revolution of the hand of that dial.

"A complete revolution of the hand of any dial is represented by one sub-division of the next dial to the left. Thus, each sub-division of the lower right-hand dial represents 100, and one complete revolution of the hand of that dial represents 1,000, and is registered by the next dial to the left and represented by one of its sub-divisions, and so on through the series of dials.

As each lamp consumes 60 watts, turn on 10, only, 16-cp lamps and run them one hour, and the result will be 600 watts increase, represented by six sub-divisions of lower right hand dial. If not convenient to test with ten lamps, use five for two hours. Start with dial hand exactly on a sub-division figure.


LEARN TO READ YOUR OWN ELECTRIC METER.
1,000,000
100,000
10,000
MULTIPLY BY_____
10,000,000
1000
Above is a fac simile of the dial plate of a Thomson Recording Watt Meter. The figures under each dial represent the amount of a complete revolution of the hand of that dial.
A complete revolution of the hand of any dial is represented by one sub-division of the next dial to the left. Thus each sub-division of the lower right hand dial represents 100, and one complete revolution of the hand of that dial represents 1,000, and is registered by the next dial to the left and represented by one of its sub-divisions, and so on through the series of dials.
As each lamp consumes 60 watts, turn on 10, only, 16 C. P. lamps and run them one hour and the result will be 600 watts increase, represented by six sub-divisions of lower right hand dial. If not convenient to test with ten lamps, use five for two hours. Start with dial hand exactly on a sub-division figure.
BE SURE TO MULTIPLY BY FACTOR ON DIAL PLATE (if any) to arrive at correct results.
This method of testing a meter is approximately correct and sufficient for all practical purposes, but not as accurate as a scientific test with instruments.
Lamps should not be used after the glass has become blackened.
BUTTE ELECTRIC AND POWER CO.

"Be sure to multiply by factor on dial plate (if any) to arrive at correct results.

"This method of testing a meter is approximately correct and sufficient for all practical purposes, but not as accurate as a scientific test with instruments.

"Lamps should not be used after the glass has become blackened."

A Pointer for Sign Solicitors.

A very telling point in favor of electric signs and one that can doubtless be used to advantage in securing sign business in numerous cases, is made in the *Electric City*, published by the Chicago central station interests. The following short article accompanied a night photograph of the drug store sign in question:

HOW AN ELECTRIC SIGN MAY BE THE MEANS OF BETTERING AN INFERIOR LOCATION.

Drug stores are usually looked for on a corner.

In the present instance, that of the Grand Pacific pharmacy of Rogers & Diamond, the store is the second from the corner, on Clark Street, . . .

Before the electric sign was installed there was nothing to indicate to pedestrians that there was a drug store in the block. Strangers in the city, passing on Jackson Boulevard to the various railway stations, or pedestrians north or south of the

location on Clark Street, would never have known that there was a pharmacy anywhere in that neighborhood.

With the electric sign in operation the Rogers & Diamond location is quite equal to a corner location without a sign, while the amount saved by reason of a lower rental for an inside location would probably pay for several electric signs, to say nothing of the added trade the sign will actually make, by suggestion, to the many passers-by.

File Wrapper Record for Solicitors.

We have received a number of communications relating to the file-wrapper system of keeping account of prospects, as outlined on page 236 of the issue of February 3.

One central station manager writes that while he has had no experience with the system, he has known it to be applied with much success by an attorney who made a business of making collections against the farmers, and who was considered the best collector in his section of a state. He had a complete history of each collection, what a man had in crops, what he owed others, when he would pay, and about everything else which would have any bearing on the question of pay. The writer considers that the system can be applied to "new business" getting with the most efficient results, as by the records the gist of a case can be acquired in a few minutes and by one who may have had no previous knowledge of the case, so that the work can be taken up by others with no loss of time or extra expense in ascertaining previous facts.

Another correspondent suggests a modification of the system outlined, as follows:

First, an alphabetically kept card index of prospects, the cards to be numbered across the top from 1 to 31 and containing no further information than the name and the address. By placing projecting metallic markers on these cards above the desired number, all prospects demanding attention on a given date can be at once located.

Second, an alphabetically kept series of manila folders such as suggested, but having printed on the front a blank for such general information as is desirable, including the record of form letters sent, visits made, etc. This plan presents the advantage of having all of the information regarding the prospects on or in the folder, while the card record is a simple index and "tickler."

New Telephone Patents.

TWO-WIRE MULTIPLE SWITCHBOARD.

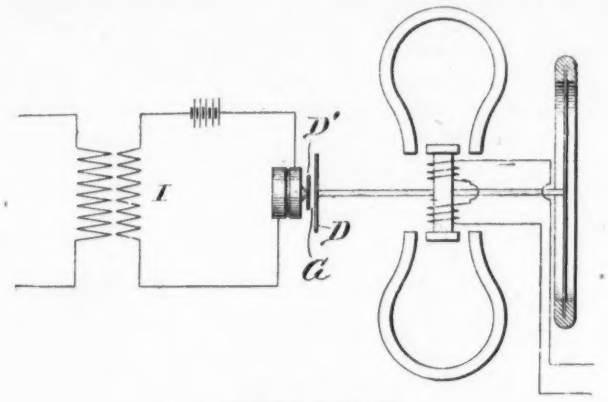
The early two-wire common-battery switchboard of the Kellogg Company was so arranged that in the normal or non-used condition the subscribers' lines were completely cut off from the jacks. In the used condition, on the other hand, the line signal apparatus was cut off from the line, and therefore it was impossible to test the line signal from the jacks. In order to accomplish such a test W. W. Dean connects the line relay side of the line permanently to the concealed spring of the jack. Thus through a plug inserted in the jack the line relay may be tested, the testing circuits being so arranged that the cut-off relay does not pull up. Mr. Dean has patented his circuit and assigned the patent to the Kellogg Company.

MULTIPLE SIGNAL TRUNKING SYSTEM.

Selective line signals have, of course, been used for years in connection with the divided multiple switchboard, but G. Lambert, of Charlottenburg, Germany, has now applied them with a new significance. Where there are in one exchange a number of different central offices, it is proposed to provide each line with a signal for each, the subscriber having selective control of his lamp. Thus, if he desires a connection with any particular exchange, he may indicate to his operator to connect him through and give the number of the desired subscriber direct to an operator of the distant exchange having access to the desired line.

TELEPHONIC REPEATER.

Another attempt has been made to solve the repeater problem, this in the shape of a refinement of a repeating device considered in this column some months since. The repeater in its present form is shown diagrammatically herewith. It will be seen at a



TROWBRIDGE REPEATER.

glance that the repeater is of the telephone microphone type, the receiver having been modified to a special type, especially sensitive. The gist of the present invention lies in the relation of the transmitting to the receiving device. It will be seen that there is no mechanical connection. The motion of the receiving part is transferred to the transmitting part by the thin layer of air at *G* between the two plates, *D* and *D'*. In practice these will be secured to the same mounting, which will take the form of an annulous. Thus the two diaphragms will form the covers of a shallow circular box. This box is not closed, but is provided with air vents as in a drum. It is claimed that with such an arrangement a vibration of the transmitting diaphragm may be caused which approaches that of the receiving diaphragm in amplitude. The inventor of this repeater is Prof. John Trowbridge, of Harvard University.

SEMI-AUTOMATIC SYSTEM.

W. M. Marean, of Belvidere, Ill., has patented a semi-automatic system wherein the information as to a desired number is sent to the central visibly without conversation with the operator. Thus, a subscriber desiring to call sets his sending device and the number desired becoming displayed, his operator connects the jack of his line with that of the desired line.

LOCK-OUT SYSTEM.

G. Ritter, of Stuttgart, Germany, has invented a lock-out system to insure privacy on a party line. His idea is that the stations may all be grouped close together and a third line conductor strung between them controlling the lock-out device. Any subscriber may lock all stations if he has control of the line, by sending current over this third wire.

SEMI-SELECTIVE RINGING SYSTEM.

For the case where two or more stations are connected upon a rural or toll line terminating in two central offices, Mr. E. A. Terpening, of Geneseo, Ill., has invented a semi-selective system. He arranges his stations with bells legged on one or the other of the sides of the line to ground. These he operates with alternating current, while the switchboard signals are operated with direct current sent metallic, these being so polarized that distinction may be made between the two central offices.

Letter to the Editors.

Central Station Cost.

To the Editors of Electrical World:

Sirs:—I have noted with much pleasure the increasing attention which your journal has during the past few years given to the business side of the central station. The growing keenness

of competition from gas has brought about a situation which central station men can no longer ignore. The glamour which at one time was associated with the use of electric light is a thing of the past, and the sale of electric energy now differs little from the sale of any commodity, and involves the employment of the methods which in other branches of business have been found necessary to success.

I think, however, that in dealing with the subject of central station business there is at present a tendency to consider only mere business getting methods and details and to lose sight of important fundamentals. I refer particularly to central stations' costs, for until these are determined in their slightest detail and constantly kept track of in the same manner as any other lines of manufacture, the central station manager is working largely in the dark. The manager should know exactly what profit he is obtaining from every class of business, to the end that he may know what classes are to be discouraged, what are to be encouraged and what may be extended with profit by a lowering of rates. Again, central stations must look forward to the time, which seems approaching rapidly, when the present movement toward the publicity of the accounts of public utility corporations will lead to legislation requiring such publicity in every State. In this event when called upon for a statement, the central station should not only have it ready in proper form, but long previously should have placed its financial affairs in order for the critical public eye. By a close analysis of cost, many central stations will undoubtedly discover unexpected sources of direct losses through unprofitable business, and indirect losses through undue returns from certain classes of business which have retarded the growth of such classes, and which returns upon publication would, through comparison with data of other central stations, give rise to adverse comment and perhaps to hostile action.

One or more of the bodies representing the central station interests, such as the National Electric Light Association and the various electrical territorial organizations, would perform an excellent service by taking up this subject, and with the aid of experts formulate a system of cost determination and accounting for central stations; or better, a system for each class of stations from those in the smaller towns to those in ordinary cities. The larger central stations can perform this service for themselves, and in most cases have already done so.

Milwaukee, Wis. Jas. L. Beard.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Idle Currents.—Field.—A paper read before the Manchester section of the British Institution of Electrical Engineers. The term "idle currents" is employed as including all currents which do not perform any useful work and which consume power to the extent of their C^2R losses. Thus the term is used to include eddy currents. The paper is chiefly mathematical. The author gives a general discussion of the idle currents met with in the main conducting circuits and then examines with greater detail one particular effect which deserves consideration on the part of designers of electric machines. This point relates to the losses of heat occurring in the heavy conductors used with large alternating currents. The current flowing through the conductors in a slot causes a leakage of magnetic field across the slot, the density of which is greatest near the top and least towards the bottom of the slot. The eddy currents are, therefore, most serious in those conductors nearest the gap surface, and in some cases they cause an extra current density as much as 30 times that of the normal current density due to the load current in the main circuit. The copper losses may thus go up enormously. So much is this the case that where there are several conductors in a slot, the one nearest the armature surface may give rise to less heat loss if made thinner and of higher specific resistance than the other conductors. Of course, by so doing the heating due to the normal load current is increased, but the extra heating due to the eddy currents is so much more important that its reduction by these means results in a decided lessening of the heat losses. Similar considerations explain another apparent paradox pointed out by the author, namely, that it is possible to use too much copper in large machines, and that in some cases the dynamo efficiency can be increased by using conductors of smaller section with slots of lesser depth.—Lond. *Elec.*, March 9, 16.

Testing Three-Phase Motors.—Moser.—The curves of tests of a motor not only show how accurate has been its design, but also enable one to determine the behavior of the same type of motor under changed conditions, for instance with changed frequency and voltage. The author describes a useful method which he calls the method of "corresponding points of load"; for such calculations it essentially depends on the use of the Heyland diagram in its simplest form, while as "points of corresponding load," such points are designated which have the same phase difference between current and voltage. It is then easy to pass over from one frequency to another one or from one saturation to another one. For practical purposes it is correct to assume that with varying saturation the current consumption for "corresponding points" varies in direct proportion with the no-load current. The watt consumption for corresponding points at constant frequency but varying saturation is proportional to the product of saturation and no-load current. For constant frequency the slip is almost constant for corresponding points. The article is illustrated by diagrams and several numerical examples are given.—*Elek. Zeit.*, March 1.

Single-Phase Induction Motor.—Fynn.—The conclusion of his long article giving what is claimed to be a simplified theory of the single-phase induction motor. In this last installment his theory is summarized in form of a series of diagrams.—Lond. *Elec. Rev.*, March 16.

Automobile Motor.—Bary.—An illustrated article on the Betrine automobile motor which permits a change of speed within limits of 1 to 2 or 1 to 4 by varying the magnetic field. The author points out that the chief requirement is to design the magnetic field in such a way that the characteristic curve of the motor has its principal bending point at a low value of induction. —*L'Ind. Elec.*, March 10.

Lamps and Lighting.

Direct-Current Flame Arc.—Mehlke.—It has been impossible in practice to increase the proportion of the additions with which the flame arc carbons are impregnated above six per cent, since above that limit the light is no longer steady. The author claims the possibility of increasing the impregnating additions with a resulting higher efficiency if the two carbons of direct-current flame arcs are impregnated with different materials. For the positive carbon metals are suitable which form bases, like calcium, magnesium, barium, while the negative carbon should be impregnated with metals which form acids, like tungsten, chromium, molybdenum. Suitable additions for the positive carbon are fluorspar and magnesia and for the negative carbon tungstic acid and chromium fluoride. It is stated that the diameter of such carbons may be increased so as to increase the life with the same length of carbons.—*Zeit. f. Beleucht.*, March 10.

Waste in Incandescent Lighting.—A full account of the long discussion of the paper of Wilkinson which dealt mainly with the trouble from using incandescent lamps for too many hours and at a low efficiency. In the discussion free lamps, as largely adopted in the United States, was thought by various speakers to be the best solution of the difficulty. Since in most cases it is not financially possible to use separate circuits for lamps and motors it was thought by several speakers to become more difficult every day to keep the regulation of pressure within 2 per

cent, owing to the demand for power at intermittent times. Automatic apparatus prevent fluctuation, but cannot equalize the pressure all over the network. If the supply companies make a point of renewing consumers' lamps and maintaining them—as gas companies do with their mantels—the cost to the consumer of electric light as a whole would be greatly reduced. Boot had tried Nernst, tantalum and osmium lamps on public lighting circuits and so far the most successful had been the osmium lamp when burning four in series on 220 volts. He believed vacuum tube lighting would prove a great boon for street lighting in future. Dickinson thought the value of the lighting load was not sufficiently appreciated; it is the lamp load that makes the profit and the companies should try to keep the rates for motor purposes up as much as possible. Emmott pointed out that exhibitions, prominent show rooms and advice on gas consuming appliances are at the service of a customer of a gas undertaking, and he strongly advocated something of this nature for central stations. It was the general opinion of the speakers that central stations should educate their customers. "It is a fault which must be laid entirely on the station engineer that the general public believe even to-day that a lamp must be made to last a thousand hours." Lamps obtained from consumers showed from 15 to 40 per cent loss in candle-power, according to the density of the blackening. Wilson spoke for the lamp manufacturers, and especially on grading the lamps. He recommended to arrange a standard voltage and to run, say, 60 per cent of all stations at this standard voltage and to grade the other 40 per cent below or above in steps of, say, 4 or 5 volts. These would help the lamp makers decidedly in grading their lamps and to keep down their stock of outfalls. In an editorial note the following table of the number of central stations in the United Kingdom using different voltages is given.

Declared voltage.....	100	102	104	105	107	110	115	120	150
Number of stations.....	48	3	1	7	1	8	3	1	2

Declared voltage	200	204	205	210	214	215	220	225	230	240	250
No. of stations.	77	1	4	28	1	1	81	8	125	60	10

It is thought that the variety in declared pressures shown in this list should be sufficient to afford a market for the outfall in 220-volt lamps.—Lond. *Elec.*, March 16.

Flame Arc Lamp.—An illustrated description of the "Juno" flame arc lamp of English make. The construction is shown in Fig. 1. A hot wire is made use of for striking the arc, but when

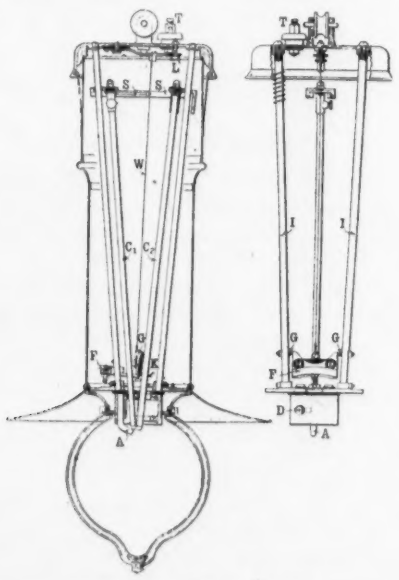


FIG. 1.—FLAME ARC LAMP.

this has once been struck the feeding of the carbons is done without the intervention of any clockwork or clutch mechanism. One of the two converging carbons, C_1, rests with its edge on a copper stop, *A*, and drops down by gravity as it burns away. Since the two carbons are mechanically connected at their upper ends by means of *S S*, however, the second carbon feeds with the first, so that the arc remains stationary and of the same length. The arc is blown out to a "flame" by a magnet in the usual manner, with the result that only the fringe of the arc just touches the copper stop, and this stop, the makers state, will last for three months when the lamp is in ordinary use. The magnetic flux to elongate the arc is created in the iron rods, *I*, which are wound with bare copper wire. This wire is insulated from the iron rod by a layer of mica and other insulators. *W* is a stout wire of a nickel-iron alloy, which also contains a little copper. When the lamp is not burning the tension of the wire, *W*, keeps the striker, *F* (whose fulcrum is at *G*), in the position shown, and the carbon, C_2, is pressed against the carbon, C_1, by the collar, *K*, which is rigidly fixed to the striker. *L* is a thumbscrew, by means of which the tension of the hot wire, *W*, can be adjusted. In order to assist cooling the middle portion of the hot wire is flattened out. If the lamp now be switched into circuit, current will enter by one of the terminals, *T T*, and, after flowing through the hot wire, the carbons and the blow magnets in series, will leave by the other terminal. The hot wire heats up very quickly and elongates, and the striker is free to rotate in a counter-clockwise direction about *G* by gravity. At the same time the collar, *K*, moves towards the right, and in doing so draws the carbon, C_2, away from C_1. In this way the arc is struck. When the lamp is fed by direct current the carbons are of different thicknesses. They are 18 in. long. With a thickness of two carbons of 8 and 9 mm., respectively, the lamp which consumes 8 to 10 amp. burns from 10 to 12 hours before it needs retrimming, while with carbons of 11 and 13 mm. the hours of burning are increased to about 20.—Lond. *Elec.*, March 16.

Tube Illumination.—Thomas.—Any intense spot of light, however small, as for instance an arc lamp, or even the filament of an incandescent lamp, causes a contraction of the pupil of the eye in order to protect the sensitive portion of the eye. In the Cooper Hewitt mercury vapor lamp the source of light is distributed uniformly over a very large area and enables the pupil of the eye to remain wide open, so that a maximum use can be made of the actual amount of light. Furthermore, the normal intensity of the tube itself is so low that after looking steadily at the lamp the eye is not dazzled, and can readily see less brilliantly illuminated objects. The net result of these conditions is that the vapor lamp has a great advantage in effectiveness over arc and incandescent lamps, quite aside from the relatively small number of watts required per candle. In the matter of distribution the Cooper Hewitt lamp, especially the longer tube, has an advantage in that the law of inverse squares, stating that the intensity of the light is inversely proportional to the square of the distance from the source, holds only with sources mathematically a point. The length of the Cooper Hewitt tube is such as to cause the intensity of the light to decrease much less rapidly with distances from the lamp than with an arc, and for this reason no definite shadows will be found.—*Elec. Jour.*, March.

Metal Vapor Arc Lamp.—Vogel.—The first part of a more detailed description of his metallic vapor enclosed arc lamp which has been noticed in the Digest. The arc is produced between two carbon electrodes within a closed globe, filled with metal vapor. The lamp is intended to combine the advantages of the arc lamp with those of the mercury vapor lamp. The article is to be continued.—*Elek. Anz.*, March 15.

Power.

Electric Power for Rolling Mills.—Belsey.—A paper read before the Dublin section of the British Institution of Electrical Engineers on the use of electric power for various purposes, especially in spinning mills, weaving mills, for bleaching, finishing and textile printing, for calendering machines, dye jigs, in foundries, in iron and steel works, etc. In rolling mills the very great variations in power offer special problems. It is necessary to use some device for automatically storing and getting out energy whenever required. This can be done either by means of a storage battery or with the aid of a buffer machine for storing the energy in a heavy fly-wheel. The latter method is both cheaper and more effective. If for instance three mills are to be driven by a total power of 1,200 kw, the power will vary be-

tween that value and the amount required to drive the mills light; the mean power may equal only 300 kw, therefore the buffer machine will have to supply for the short periods the difference between these amounts, namely, 900 kw. This buffer machine consists of a dynamo having a variable speed from 250 r.p.m. to 500 r.p.m., and upon the shaft of which is fitted a fly-wheel having a weight of about 20 tons, and a peripheral velocity of 212 ft. per second when revolving at 500 r.p.m.; therefore, at that speed the storage energy is 14,000 foot-tons, and if the fly-wheel is reduced in a speed from 500 r.p.m. to 250 r.p.m. the capacity of the fly-wheel is 14,000 — 3,500 = 10,500 foot-tons. If we assume a total loss in this buffer machine of 15 per cent, including friction and all electrical losses, then the energy available in the fly-wheel equals 27,500 hp-seconds, or 21,000 kw-seconds. Therefore, it will be seen that the buffer dynamo will give 350 kw for one minute, 700 kw for half a minute, and so on. In actual practice, however, the pulsations of load will last only a few seconds, so that the speed of the fly-wheel will never be greatly reduced. The arrangement is illustrated in Fig. 2, which

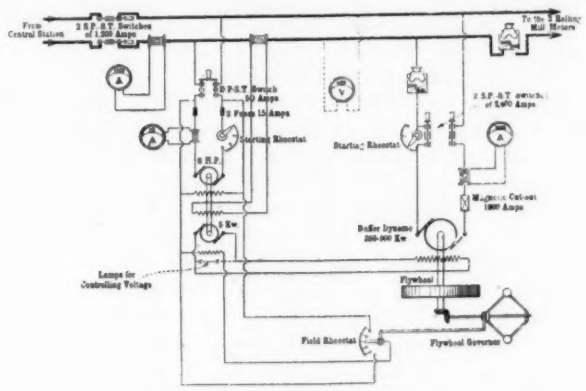


FIG. 2.—DIAGRAM OF CIRCUITS.

shows that a small motor-generator supplies the excitation for the buffer dynamo. The generator for this set is usually excited by part of the current flowing from the generating station to the rolling mill, or perhaps a better way to put it would be that it has a shunted series winding, so that as the load increases the voltage of the exciting generator increases. By this means the excitation of the buffer dynamo is changed, which, in its turn, causes a corresponding change in speed, and corresponding to this decrease or increase in speed the buffer dynamo runs as a generator or as a motor. A very interesting feature recently adopted in one of the largest steel works in Scotland has been the using of the exhaust steam from the mill engine and steam hammers etc. for driving a steam turbine. This is arranged by exhausting all the steam from the rolling mill engines, steam hammers, etc., into a calorific reservoir, which consists in some cases of a covered steel tank which is loosely filled with pig iron or some other substance which will readily absorb heat. From this the steam is passed through a turbine, and exhausts into a very high vacuum. This method has proved very successful in the utilizing of hitherto waste steam, for the steam which emerges under conditions of light load from rolling mill engines and steam hammers is practically live.—Lond. *Elec.*, March 2.

Crane.—An illustrated description of an electrically-operated rotating tower crane for the Dublin docks. It is designed to deal with normal working loads of 100 tons. The motors are direct current and operate on 500-volt circuits. The main and auxiliary lifting motors for operating hoists are of 60 and 40 hp, respectively, with speeds of 650 r.p.m.; the motor for traveling the crab is 30 hp with a speed of 750 r.p.m. The operation of slewing is performed by a 15-hp motor with a speed of 570 r.p.m. —Lond. *Elec. Rev.*, March 16.

Power Plant Design.—CLARK.—A discussion of tendencies in power plant design, especially the increase of the size of units, the introduction of labor-saving devices and greater operating economy. In view of the very high efficiency of electrical generators the power plants of the future must endeavor to excel those of to-day in the generation of mechanical rather than electrical power.—*Cassier's Mag.*, March.

Traction.

Birmingham.—The first of several illustrated articles describing special features of the system of the Birmingham Railway, Light & Power Company upon which upwards of $3,000,000 are being expended for improvements. Power for the entire railway, lighting and steam heating business is supplied from one power house, which is being completely remodeled and extended.—*St. R'y Jour.*, March 24.

Automobile.—An illustrated description of the Pieper petrol-electric system of automobiles. Only one electric machine is employed, which operates either as dynamo or motor. A small battery supplies reserve power for starting the car and hill climbing, and it is also used for starting the engine, working the ignition, lighting the lamps and other auxiliary purposes.—Lond. *Elec.*, March 2.

Installations, Systems and Appliances.

Economy of Central Stations.—HOPPE.—The conclusion of an article discussing the quite unsatisfactory results which are obtained in various German central stations of smaller or medium size. The author thinks there are especially three reasons for the poor commercial results obtained. First, the lighting energy tariff is in general too high and the motor energy tariff too low; as a matter of fact, in most cases a decrease of the fundamental rate for lighting energy has resulted in an increase of the mean yearly receipts per connected kilowatt, while a decrease of the fundamental rate for motor energy generally results in a decrease of the mean receipt per kilowatt. Secondly, many German stations have been too elaborately built and look more like palaces than power stations. Thirdly, many German cities have several stations while the combination of the same in one single station would be far more economical. Some notes are given on a method for predetermining the commercial economy of a new central station.—*Jour. f. Gasbeleucht*, February 24.

Methods of Charging.—A note stating that the Wright maximum demand system has done much to educate central station engineers, although many central station men have now substituted for the maximum demand system flat rates of charging, with discounts which make sufficient allowance for the character of the load of individual consumers, and there are now comparatively few towns in which the Wright system is the only tariff in use. In some it has been abandoned altogether, while in others flat rates are offered as an alternative method of charging. Brighton, the town in which the maximum demand system was born, has hitherto been among those in which every consumer was charged on the maximum demand system, but the Brighton municipality has now decided to give every consumer the option of being charged at a flat rate of 8 cents instead of on the Wright system at 14 cents for the first hour and 2 cents after. As it requires a two-hours' use of the maximum demand per day at 14 cents and 2 cents to bring the average charge down to 8 cents per unit, it is probable that a large number of consumers will adopt the alternative.—Lond. *Elec.*, March 9.

Automatic Boosters.—SCHROEDER.—A paper read before the Berlin Elec. Soc. on the use of automatic boosters in electric power plants. They have been installed in the past only in a single instance in Germany, but are now beginning to attract more attention.—*Elek. Zeit.*, March 8.

Wires, Wiring and Conduits.

Electric Installations for Collieries.—PREECE AND MAURICE.—Two papers presented before the British National Association of Colliery Managers. The paper of Preece deals with the manufacture, application and distribution of electric cables for collieries. He first describes the various types of cables which are used in collieries. These types are: (1) Vulcanized rubber-insulated, taped and braided, sometimes lead-covered and armored; (2) vulcanized bitumen cable, braided or served over all with jute; (3) paper-insulated cables, further insulated with a sheathing of vulcanized bitumen and protected as No. 2; (4) paper-insulated cable, lead-covered and sometimes braided or

served and armored. The first type is the oldest one, and, in the author's opinion, it is a moot point even now—especially as regards the highest grades—whether these cables are not the best. He knows of cables which have been working for over 15 years and are still running. Cheapness, however, should never be the determining factor in the choice of rubber cables. The use of the second type is increasing, especially for shaft work, and it might be considered a standard cable for voltages up to 600. Beyond that pressure paper bitumen cables of type No. 3 are superior. It is advisable to work bitumen cables at a current density not above 800 amp. per square inch. Bitumen cables of good design withstand the action of pit waters very well. An important point in the use of types 3 and 4 is the necessity of effectively sealing the ends to prevent the entry of moisture, sealing boxes filled with bitumen being the safest, though good protection is afforded by using bitumen tape and vulcanizing in bitumen for a few seconds. Type 4 might be the best cable from the electrical and permanence point of views, but unsatisfactory results have been obtained with it due to carelessness both in installation and in maintenance. The paper of Maurice suggests the general adoption of a set of conventional signs in order to systematize the drawing up of plants and to make it possible to read at a glance the arrangement of any given plant.—*Mining Mag.*, March.

Conduit Wiring.—A paper read before the British Electric Contractors' Association. The author, who is not named, remarks that the practice of electric wiring has passed from the stone age to the wood age and more recently to the metal age. He gives a review of the development of steel conduits for electric light installations. He calls attention to a risk in connection with the conduit wiring of buildings which will remain as long as it is permitted to use gas pipes of the "compo" description. Continuity and earthing are very advisable on high-voltage work from the point of view of protection from danger to life, but they provide little safeguard against fire risk, unless care is taken to keep metal conduits spaced apart from such gas pipes and, of course, from any metal work in connection with them. The author discusses whether it is desirable to use a brazed or solid drawn tube or whether it is not actually advantageous to use an open seam and socket fittings. The latter are recommended by various engineers for surface work, the seam being placed lowermost so as to effectively drain the tube, and produce good ventilation. In situations containing steam or vapor, such as in baths, laundries, boiler rooms, etc., the moisture from the outside is more to be feared than condensation, and here the use of the seamless screw tube is desirable. For concealed work, switch runs and the like, the open-seam conduit is unsuitable, wherever switch runs are buried in plaster or cement.—Lond. *Elec.*, March 2.

High-Tension Cable.—An article giving the results obtained with an underground three-phase cable of Geoffrey and Delore in a plant of the French Thomson-Houston Company. The cable withstood successfully in industrial operation an effective e.m.f. of 27,000 volts between the conductors and 15,000 to 16,000 volts between one conductor and earth.—*L'Ind. Elec.*, March 10.

Fuses.—Harvey.—A paper giving characteristic curves of fuses, discussing their standardization and the different types of fuses. —*Elec. Jour.*, March.

Electrophysics and Magnetism.

Calibration of Gold Leaf Electrometers.—Schmidt.—The gold-leaf electroscope is being widely employed in measurements of ionization. It is calibrated by applying known potentials to it. The author points out that it is not as a rule used for measuring differences of potential, but for measuring currents by noting the variation of the potential. To obtain the best results, therefore, another principle of calibration should be employed. The relative difference of potential between two scale divisions may be obtained by exposure to the beta and gamma rays of a radium preparation fused into the glass wall, and noting the times taken by the leaf to traverse successive divisions. If there is a saturation current, these times are proportional to the differences of potential. If the shape of the electroscope causes a doubt as to whether there is a saturation current it is only necessary to connect the electroscope with an air condenser which is not too small, and to expose this alone to the radium rays. The author believes that with a well-calibrated leaf electrometer as good results may be obtained as with a quadrant electrometer. Moreover, it has the great advantages of simplicity, small capacity and independence of external disturbances.—Lond. *Elec.*, March 16; from *Phys. Zeit.*, March 1.

The Corpuscular Theory of Matter.—J. J. Thomson.—A long abstract of his second lecture on this subject. He discussed the methods for determining the mass and charge of negative electrons (corpuscles) and of positive ions.—Lond. *Engineering*, March 16.

Electrochemistry and Batteries.

Asymmetrical Action of Alternating Currents on a Polarizable Electrode.—Gundry.—An account of experiments made to explain the action of the electrolytic coherer whose resistance is changed by the impact of electric waves. The object of the paper is to show that in a polarizable electrode in general, as soon as one passes beyond the stage of initial capacity, the alternating current gives rise to an asymmetry which would appear as a coherer effect. The experiments of the author consisted essentially in the sending of an alternating current of frequency varying between 80 and 5,000 periods per second through an electrolyte between two mercury electrodes, of which one was very small, the other more than a thousand times as large, so that the latter may be considered as unpolarizable in comparison with the former. The results obtained by the author show that a perfectly symmetrical alternating current acting at a polarizable electrode leads, according to Nernst's osmotic theory of polarization, to an asymmetry of the polarization; in other words, to a direct current. The product of the direct current and of the frequency is proportional to the square of the amplitude of the alternating current. The direction of the current corresponds with an effective diminution of the concentration in the neighborhood of the electrode. An explanation of the action of the electrolytic coherer is proposed.—*Phil. Mag.*, March.

Granulated Carbon as Resistor.—Brown.—An account of experiments on the use of granulated carbon as heating material for electric resistance furnaces. The author has especially studied the changes which the resistance of such a material undergoes when it is first connected to the circuit. This material of granulated carbon is called kryptol by the author, while the same name now usually stands for a mixture of granulated carbon, graphite, sand, clay and other silicates, etc.—*Elek. Zeit.*, March 1.

Storage Battery.—Rosset.—The first part of a discussion of the chemical and electrochemical requirements of the grid of a storage battery, and of the gain in capacity due to a decrease of the relative weight of grid.—*Centralblatt f. Accum.*, March 15.

Units, Measurements and Instruments.

Oscilloscope.—Jones.—Some notes on the Ruhmer glow-light oscillograph which employs a special form of vacuum tube as a means for observing the wave forms of high potential discharges. It is based on the fact that in a vacuum tube the area covered by the glow upon the negative wire is proportional to the magnitude of the current through the tube. When a suitably exhausted tube is traversed by a high potential discharge the negative wire is partly covered by a violet glow, which seems to form a luminous sheath to the free extremity of the wire along which it also extends for a certain distance. With increase of current the area covered by the glow lengthens out, and with decrease of current it becomes shorter. If the current is alternating, then both wires show the negative glow, but to an unequal degree. To the eye the glow appears steady, but when viewed in a revolving mirror it is found to form upon each wire alternately and to rise and fall in time with the variations of the current, and so it traces out the contours of the wave impulses of which the discharge consists. The Ruhmer tube is shown in Fig. 3, being 35 cm. long and 4 cm. in diameter, with two slender rigid nickel wires arranged axially. The distance between their ends is about 2 mm. and a disc of thin porcelain or mica is fixed at this point. It is pierced by a small hole which corresponds with the

ends of the electrodes. The degree of exhaustion corresponds to 6 mm. of mercury. Fig. 4 shows curves of the induction coil discharge. The curves below the zero line give the induction coil currents at make, and those above it at break, and show very

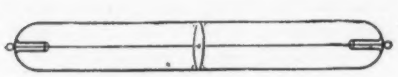


FIG. 3.—RUHMER TUBE.

FIG. 4.—DISCHARGE CURVES.

clearly the gradual rise of the make e.m.f. and the sudden rise of the net break e.m.f. Some other curves obtained by the instrument are also given.—Lond. *Elec.*, March 16.

Spherical Photometer.—A long illustrated description of the spherical photometer for measuring the mean spherical candle-power by a single observation, with abstracts of papers by Ulbricht and Bloch on the subject, which have been noticed in the Digest.—Lond. *Elec. Rev.*, March 16.

Telegraphy, Telephony and Signals.

Magnetic Detectors of Electric Waves.—Russell.—An account of experiments in which the author measured the effects of parallel and traverse oscillations upon the magnetic properties of iron, with a view to explain the action of the various patterns of magnetic detectors of electric waves. He finds that Marconi's second instrument detects the increase of induction which occurs when electric space waves are superposed upon the fields at or near a cyclic extreme, in precisely the same way as Rutherford's original apparatus detected, or rather measured, a decrease at another point of the cyclic process. The function of the moving band appears to be twofold: First, it supplies the hard iron or steel in a condition of lower permeability, in order that it may be raised to a condition of higher permeability when the signals are received from a distant station; and, second, it distorts the field in the direction of motion, the telephone thus tending to respond in a greater degree to signals received when the field is increasing near, but not at, the cyclic extreme. For low field this is the most sensitive part of the cycle. The Ewing-Walter form of detector is essentially different. It is based upon Ewing's hysteresis tester, which measures the drag between field and iron when one of these is revolving. The best speed is stated to be from five to eight revolutions per second, while Marconi obtained good results at a speed of only half a revolution per second. The reason for this great difference is obvious. The Marconi instruments detect instantaneous induction change, while the Ewing-Walter form integrates.—Lond. *Elec.*, March 2.

Miscellaneous.

Carbon Factory.—Illustrated descriptions of the Witton carbon factory of the British General Electric Company, making carbons for electrical purposes.—Lond. *Elec.*, *Elec. Rev.* and *Elec. Eng.*, March 16.

BOOK REVIEW.

Annuaire Pour L'an, 1906, Publié Par le Bureau des Longitudes. Paris: Gauthier-Villars. 940 pages. Price, 1.50 francs.

The present issue of this annual publication contains the usual astronomical, physical and chemical data together with two papers of timely interest on total eclipses of the sun with special reference to the eclipse of August 30, 1905. M. Bigourdan, member of the Bureau des Longitudes, writes at considerable length on the various observations to be made during the short period of totality, and shows the importance of adequate remote preparation as well as prolonged proximate drill. The paper is indeed a little treatise on the subject which will be read by all students of astrophysics with unusual interest. M. Bigourdan took an active part in observing the eclipse of last August, being stationed on the line of totality of Sfax in Africa, where he obtained numerous important results.

In enumerating the stations and observers, he states that Janssen, the dean of French astronomers, despite the weight of his 82 years, went to Alcosbre, in Spain, to observe his seventh eclipse, and was rewarded with valuable photographs of the corona as well as spectrograms of the corona, the chromosphere and the reversing layer. The *Annuaire* closes with a short account of these results from the pen of M. Janssen himself.

Some New Direct-Current Switchboard Instruments.

By A. O. Benecke.

Recently in designing a line of switchboard instruments for use on direct-current circuits the writer carefully analyzed the various causes of inaccuracy and failure of such instruments to operate properly under actual working conditions. He has reached the conclusion that everyone of these causes can be avoided and that it is possible to produce instruments which will effectively withstand transportation, the usual handling in erection and the most trying conditions of service on switchboards, and which will retain their accuracy and reliability almost indefinitely.

The movable coil permanent magnet type instruments have been in general use for years, and the principle employed in their construction is universally considered to be the most satisfactory for measurements on direct-current circuits. It is, however, generally known that these instruments do not remain equally reliable on switchboards as when used in laboratory work. The reason for this, of course, cannot be charged to a fault in the principle, but is due to the fact that the instruments have been constructed too delicately and are too fragile to withstand handling by inexperienced men, and the trying working conditions which exist in stations.

No one would ever attempt to mount a delicate chronometer on a vibrating switchboard, but would select for such a purpose a less sensitive clock. Nor would any chronometer maker recommend the use of one of his instruments where vibrations, excessive changes in temperature, etc., are unavoidable. In reference to electrical measuring instruments, however, it has been the custom to construct the same as delicately as possible, and to expect their accuracy to be as reliable under the conditions existing in a central station as if carefully erected and carefully handled by experienced men in the laboratory.

The large majority of cases in which instruments fail to indicate properly may be attributed to friction which is due either to damaged pivots or jewels or to an accumulation of dust or other small particles between the movable and stationary parts of the instruments. It seems to be self-evident that the cases protecting the instruments proper should be dust-proof, but a close inspection shows that very few of the so-called dust-proof cases really deserve this name.

The peculiar form of pivots and jewels generally employed in electrical measuring instruments cannot withstand the jarring in transportation or the vibrations found in central stations. It must be admitted that the conical pivots and conical jewels constitute the most frictionless bearing if perfect, but serious friction develops as soon as the microscopical point of the pivot is broken off. In instruments with a horizontal axis a considerable displacement of the movable coil takes place as soon as the pivot becomes damaged, or when the distance between the two jewels becomes slightly altered by expansion due to temperature changes, and it is not a rare case that this displacement brings the movable coil in direct contact with the core or pole pieces of the magnetic system. Instruments with conical pivots will seldom show any friction under the first laboratory tests and the manufacturer seems to be satisfied that this way of pivoting the movable coil is the easiest and has therefore adhered to it. The mechanical difficulties to be overcome in producing instruments with cylindrical pivots and journaled in watch jewels are undoubtedly greater, but when once accomplished an instrument of this kind will remain practically frictionless forever. There is no possibility of the pivots or jewels becoming damaged under any ordinary conditions.

Another defect found in instruments is the insufficient insulation of the current carrying parts. Connections are often made by thin wires not properly supported which can easily come in contact with each other or the case, causing not only inaccurate indications but frequently the complete burning out of the instruments.

Appreciating the above enumerated facts the writer has taken special care to insulate all parts of the instruments from their enclosing cases, to make these cases absolutely dust-proof by providing large contact surfaces where detachable parts are joined, and to employ highly polished cylindrical steel pivots and perforated jewels.

Besides these vital points other minor ones have been carefully considered. By the selection of a proper winding for the movable coils the instruments have a somewhat larger torque, which permits the use of stronger controlling springs. Zero errors so often noticeable in oth r instruments are completely avoided. All voltmeters are adjusted to the same resistance per volt and therefore multipliers can be interchanged. The same plan has been adopted for the shunts of ammeters. The scale opening in the front of the case is somewhat larger than usual; thus more light is admitted to the scale and it can be read more clearly.

Scales for the different ranges are divided in such a manner that the indications of the instruments are easily read without any mental calculations. The instruments are regularly provided with back connections, but can be converted into instruments with front connections if preferred. All instruments can be mounted flush with the switchboard by the mere addition of a special guard ring.

The American Instrument Company, of Newark, N. J., will shortly place on the market these instruments in different sizes and ranges to suit all the requirements of isolated plants and central stations.

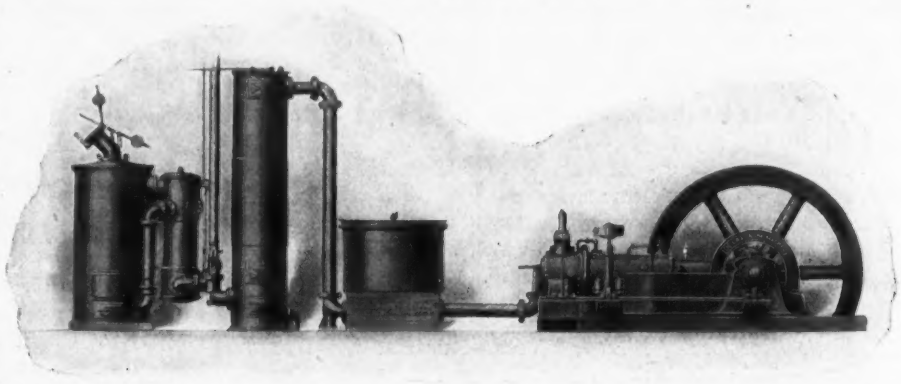
Producer-Gas Power in Electric Stations.

By Dr. Oskar Nagel.

In Germany and Austria a considerable number of gas engines and gas producers, especially of the Koerting type, are in successful use for municipal electric light plants and electric stations in public buildings, depots, post offices, etc. Several years of experience have shown that such a gas power plant is fully as reliable as the best steam plant and has the advantage of much greater economy. The slow speed and heavy construction of the Koerting engine make this machine absolutely reliable, the extremely sensitive governor gives close regulation and the Koerting mixing valve insures greatest economy.

Above are given some figures from actual practice of several German plants. It must be borne in mind, if comparison is made with steam plants, that the gas plants referred to below are of small size, are working only a relatively short time every day, so that the average load is rather low and the standby losses considerable. If all these points are taken into consideration it will be found that the total coal consumption per kw-hour is extremely low. The cost of lubricating oil is not higher than in a steam plant and the cost of attendance is considerably lower.

In Pressburg, Hungary, a 125-hp Koerting gas power plant is running in the electric central station according to a guarantee of 1.4 lb. of furnace coke per hp-hour at full load, and 1.7 lb.



GAS PRODUCER OUTFIT.

at half load. During a test of 8 hours one kw-hour was developed from 0.25 lb. less coke than the guaranteed consumption.

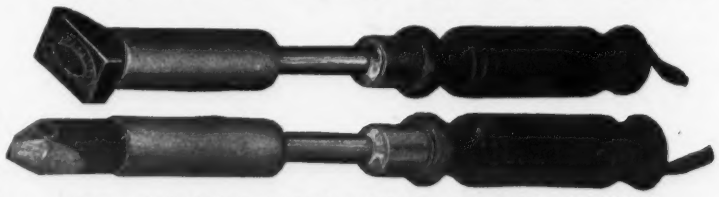
A complete Koerting suction gas producer outfit comprising producer, evaporator, wet scrubber, sawdust scrubber and engine, is shown in the accompanying cut. A plant of this kind is in continuous operation at the works of the De La Vergne Machine Company, New York.

Gas Engine Producer Central Stations. 1902-3. Koerting Engines and Producers.

Place.	K.w.-hours, gen'd.	K.w.-hours, deliv'd.	K.w. per 1 lb. coal, gen'd.	K.w. per 1 lb. coal, deliv'd.	Lubricating oil—total (lbs.)	Lubricating oil—per k.w.-hour (grams)	Cotton waste—total.	Cotton waste—per k.w.-hr.	Coal lbs. per yr.	H.P. capacity.
Clausthal	219150	195943	0.36	0.33	2708	5.60	514	—	599317	100
Gransee	51847	44748	0.36	0.31	640	5.62	67.1	0.558	144238	100
Neumarkt	125076	98711	0.37	0.3	1984	7.22	121	0.442	333830	80
Neurode	119800	94731	0.24	0.21	798	3.03	375	1.42	509280	160
Reichenbach	49437	45418	0.3	0.27	673	6.20	53.9	0.500	59534	60
Soberheim	95326	80000	0.36	—	1540	7.36	730	3.50	263995	100
Schoenberg	58514	46638	0.35	0.29	1654	12.80	163	1.3	168069	80
Schwetz	82312	67072	0.398	0.33	880	4.81	191	1.06	206817	160
Walserorde	60352	53940	0.32	0.29	1086	8.24	266	2.03	187413	70
Wienenden	71828	—	0.24	—	1102	6.97	312	1.98	287738	160
Post Office.										
Karlsruhe	70766	61693	0.45	0.39	798	5.14	168	1.08	157874	100
Depot.										
Werdan	102716	92607	0.36	0.32	1375	6.07	673	2.99	286341	90

Electric Branding Apparatus.

An interesting exemplification is shown herewith of the use of electrical branding appliances. The engraving is from a photograph of an actual brand sold by L. P. Brown & Co., 71 West Jackson Boulevard, Chicago, to the Chicago Law Institute. The electrically-heated brand is quickly made ready by turning on the current, and it imprints permanently the name of the owner upon the book or other object upon which it is used. These branding devices may be used in a great many ways. Many thousands of tool handles are thus branded, and this work can be best done by electricity. The firm makes a large line of electric soldering and branding tools, which are interchangeable by simply changing the tips so that it is possible for one tool to do both classes of work. These are made in various sizes and shapes adopted to special use. The firm believes that this new line of branding appliances opens up a field for central station managers to increase



INTERCHANGEABLE ELECTRIC BRANDING AND SOLDERING IRONS.

the sale of electric energy which is well worth looking into. The company is well known as a manufacturer of electric soldering tools, but the electric branding iron is an addition to its product.

Lincoln Variable-Speed Motor.

The variable-speed motor illustrated herewith is unique in the method employed in obtaining the speed variations. The motor is an ordinary shunt-wound machine. The armature is similar to the armature of any shunt-wound motor.

The speed variation is obtained by withdrawing the armature from the influence of the field poles. As the armature is withdrawn the magnetic reluctance between the field poles and the armature increases, thereby decreasing the magnetic flux and increasing the speed.

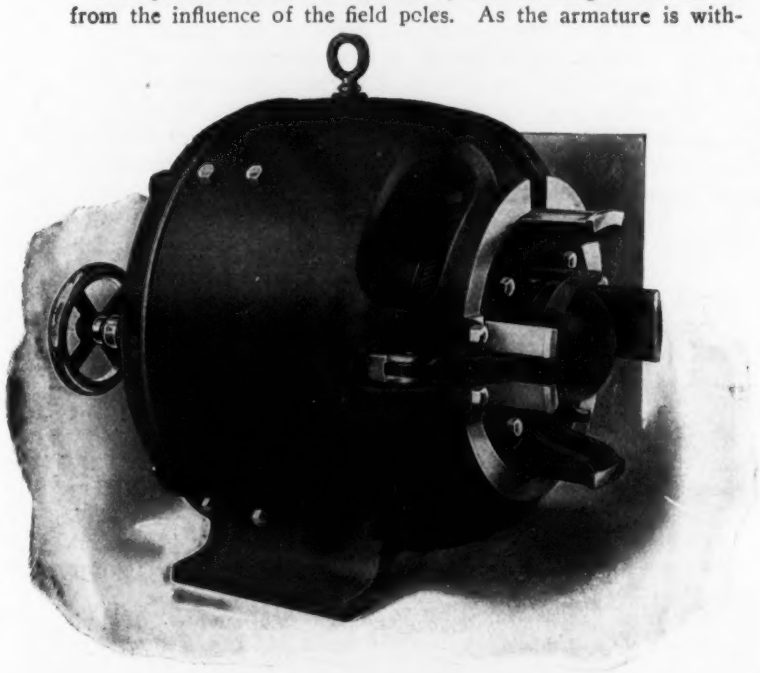


FIG. 1.—VARIABLE-SPEED MOTOR.

It is possible to obtain a more marked change in speed with a given lateral motion by making the armature slightly conical. When a conical armature is used, the withdrawal of the armature decreases the area of the air gap in the same proportion as it would if a cylindrical armature was used, but at the same time increases the length of the air gap which would not occur with the cylindrical armature. Thus the increase in the reluctance of the air gap is greater with a conical armature than with a cylindrical armature for a given movement.

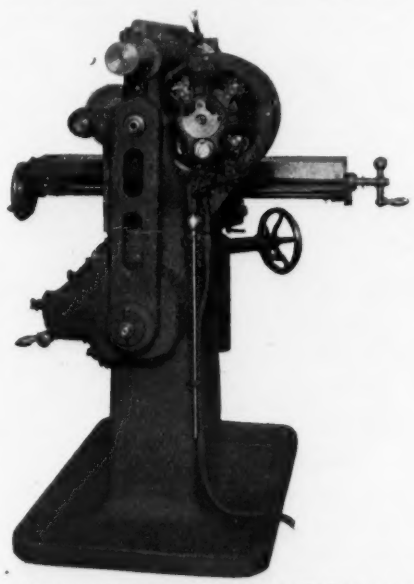


FIG. 2.—MOTOR DRIVING UNIVERSAL MILLING MACHINE.

As the armature is withdrawn, the speed increases. The machine is provided with special commutating poles, under the influence of which the armature comes as it is withdrawn into its positions of high speed. The special commutating poles produce sparkless commutation at all loads from no load to 100 per cent overload.

Exceptionally wide ranges of speed are secured with this construction. A variation of 10 to 1 is easily reached and wider variations can be obtained if there is a demand for them.

The reason why this motor permits so much wider variation in speed than are obtained by the ordinary methods of field weakening, is that there is less distortion of the main flux at high speeds than there is at the low speeds. This is due to the fact that the full field strength is used no matter what the speed of the motor may be.

A hand wheel is used in connection with a screw mechanism to move the armature laterally and by means of this hand wheel it is possible to get an infinite variety of the speeds from the lowest to the highest. A simple reversing switch allows the motor to be run in either direction with equal results.

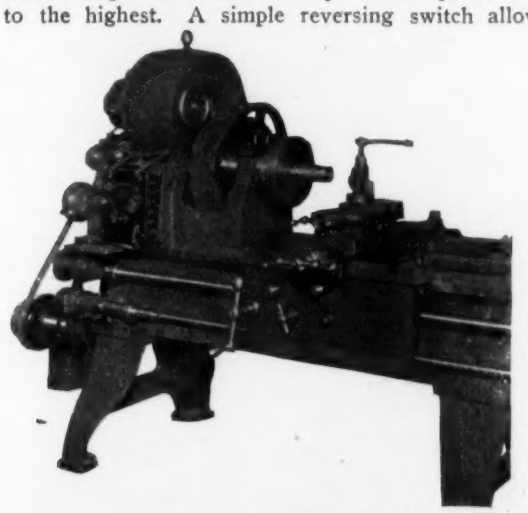


FIG. 3.—LATHE DRIVEN BY 5-TO-1-SPEED MOTOR.

The magnetic pull of the armature is carried on ball thrust bearings which minimize the friction. The brushes are mounted on the same structure as the thrust bearing and, as the thrust bearings, armature and commutator all move together, there is no relative lateral movement between the commutator and brushes.

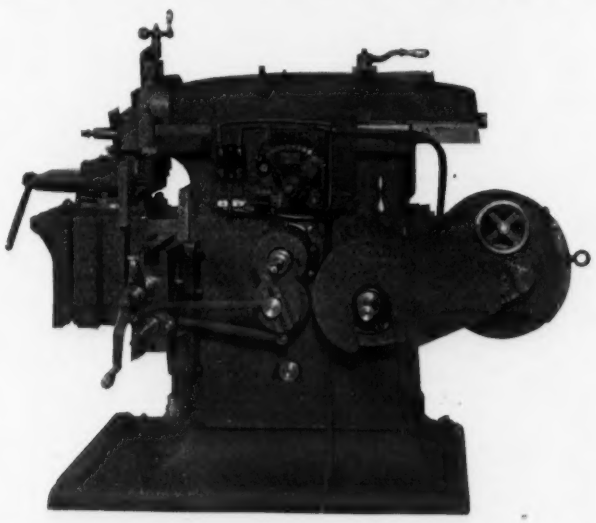


FIG. 4.—SHAPER CONNECTED THROUGH SILENT CHAIN TO VARIABLE-SPEED MOTOR.

To accomplish this there has been designed a thrust bearing that supports the commutator end of the armature, carrying an annular ball bearing to take both the thrust and the radial loads. This thrust bearing is actuated by a split lever having a central pull on opposite sides of the thrust bearing, movement of the lever being accomplished by means of a screw mechanism and

hand wheel as illustrated in Fig. 1, a spring around the lever connecting rod being adjusted to balance up the magnetic pull of the armature.

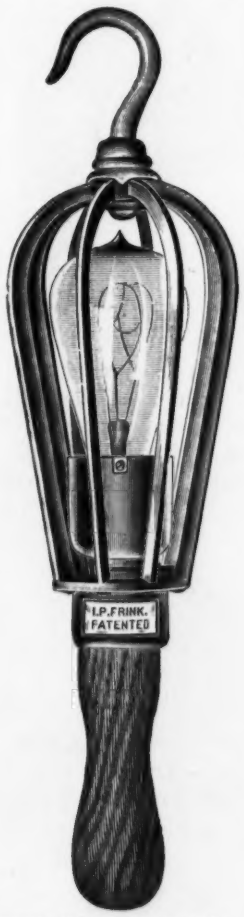
It is stated that the field and the armature coils are shaped and treated so as to provide the best ventilation and heat radiation, so that notwithstanding the exceptional small size and weight of the motor, the heating, even at very low speeds employed, is well within the margin of safety.

Three applications of these motors are indicated in Figs. 2, 3 and 4. Fig. 2 shows a No. 2 universal milling machine driven by a 2-hp motor having a speed range from 375 to 1,875 r.p.m. A 20-in. lathe driven by a 3.5-hp motor with a speed range from 350 to 1,750 r.p.m. is shown in Fig. 3, while Fig. 4 shows a similar motor driving a 16-in. shaper.

This type of motor has been designed by Mr. John C. Lincoln. It is being placed upon the market by the Lincoln Electric Manufacturing Company, Cleveland, Ohio.

Portable Lamp Guards.

The flexibility of incandescent lighting has led to the universal use of portable lamps, which can be carried around a room or a machine and be employed to throw a strong light temporarily on some particular object or part of it. The demand for improved and substantial forms of guards has led the old and progressive house of I. P. Frink, 551 Pearl Street, New York City, to develop the portable lamp guard herewith. It is of unusually heavy construction, experience having shown that lamps thus used get a lot of rough handling. The ribs of the guard are made from stout galvanized Bessemer steel. The hook being unscrewed at the top, the guard is easily unlocked for relamping; and the parts are so closely fitted there is no possibility of their suffering from jarring or vibration. Moreover, no strain whatever comes on the terminals or the socket. Although the ribs of the guard are so massive the strength lies in the depth rather than the thickness of the ribs, and hence there is a minimum obstruction of the light from the protected lamp. The guard has already had a thorough test around lighting plants, trolley roads, pressrooms, etc., and has been found an admirable new adjunct of illumination.



PORTABLE LAMP GUARD.

New Resistance Box and Wheatstone Bridge.

Queen & Co. have recently brought out a new universal Decade box and Wheatstone bridge with several novel features, and which is considerably smaller in size, but in arrangement very similar to the well-known Anthony form.

The rheostat proper consists of fifty coils, ten each of tenths, units, tens, hundreds and thousands, and so arranged that all the coils in any bank can be connected in series, multiple or various combinations of the two. This arrangement lends itself particularly well to the thorough and complete interchecking of the coils. For instance, the ten 100-ohm coils can be connected in multiple and compared with each 10-ohm coil, which latter in turn can be compared with the ten 1-ohm coils connected in series, and this interchecking can be extended to the other coils in the rheostat.

The bridge consists of a unit, 10, 100, 1,000 and 10,000-ohm coil in each arm, which latter by means of a commutator can be reversed and their equality determined to a nicety. Battery, galvanometer and line posts are provided and in the galvanometer and battery keys special care has been taken to use a gauge of metal which will not tire the operator and yet which will allow perfect electrical contact to be made. The connections are engraved in dotted lines on the hard rubber top, the double line indicating the heavy interior connections and the single lines showing the galvanometer and battery circuits. The lower edges of the metal blocks and bars facing each other are beveled slightly, and owing to the circular form of metal block much greater insulating space is secured than with the older form of rectangular block.

The coils are wound with manganin wire thoroughly shellaced, aged and baked. The accuracy of adjustment of the bridge coils is 1/50 per cent; that of the thousands, hundreds and tens in the rheostat 1/25 per cent, the units 1/10 per cent, and the tenths ⅕ per cent of their stamped values.

The perforated metallic sides allow a free circulation of air, which together with the zero temperature coefficient quality of the wire which is used, make the box practically independent of temperature. If requested a table of readings accurate to 1/50 per cent will be supplied with each set, showing the actual measured resistance of each coil. Twenty-four plugs and two travelers are supplied. When not in use a polished hardwood mahogany cover, similar to the box itself, fits over the hard rubber top

RESISTANCE BOX AND WHEATSTONE BRIDGE.

and plugs, effectually protecting them from dirt and the action of the light.

This set is particularly intended for use in the ordinary laboratory where accurate measurements are necessary and yet the expense of one of the large Anthony type bridges would not be justified.

Electric Lighting Specialties.

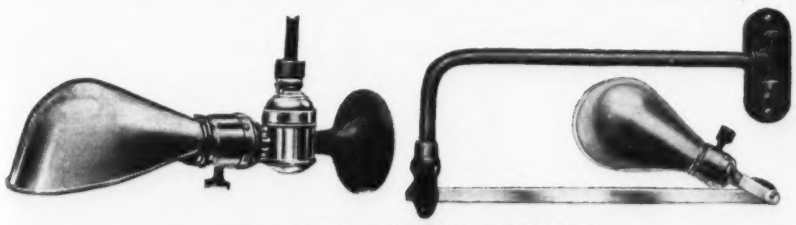
Among the first products of the H. C. K. Company, 45 Broadway, New York, which has been organized to manufacture high-grade electrical and mechanical appliances, are a number of new types of adjustable portable and bracket electric lamp fixtures. In the accompanying illustrations Figs. 1 and 2 show a portable lamp which may be adjusted at any angle and which includes a shade which may be rotated in its socket around the lamp. The double hinge which supports the socket is of a design which absolutely prevents sagging of the lamp, a common defect of other portables. Placing the lamp in the upright position makes it a

FIGS. 1, 2 AND 3.—LIGHTING SPECIALTIES.

portable suitable for the flat top desk or table. By placing the stem in a horizontal position relative to the base, as shown in Fig. 2, the portable is suitable for the illumination of roll top desks, pianos, filing cabinets, etc.

Fig. 3 shows a pair of lamps mounted in a "horizontal" key socket. The key sockets swivel around the supporting cord or stem and the lamp shades may be rotated on the sockets around the lamp, thus permitting the light to be directed and concentrated wherever it is required. The top cap is threaded for ⅜-in. pipe thread so that the fixture can be screwed to a standard outlet. The swivel motion is limited to one full revolution, thus entirely obviating the use of collector rings, brushes or any working contacts. It is claimed that with this fixture 16-cp lamps may be satisfactorily displaced by 8-cp lamps, thus effecting a saving of 50 per cent in meter bill. Fig. 4 shows how one lamp socket may be removed and the fixture installed as a single lamp fixture; this latter may also be used upright, the effect of which may be seen by turning the engraving to 90 deg.

Fig. 6 shows a bracket adjustable in all directions and strong and durable as well as ornamental. The wall plate supports a



FIGS. 4 AND 5.—LIGHTING SPECIALTIES.

swinging arm bent at one end, on which is screwed a rotatable head made in two parts held together by two thumbscrews. The inner sides of the head are provided with two friction discs which grip without cutting or scratching the ½-in. brass tube when under tension. The square tube can be moved in or out and set at any angle desired without any possibility of sag or wear. At the end of this tube is a double-sided hinge with two thumbnuts to hold it in place. The shade may be rotated around the socket directing the light to any point desired. When the light is not required, the bracket can be pushed out of the way against the wall, as shown in Fig. 5. Practically all the position adjustments can be made without tightening or loosening any screw, clamp or

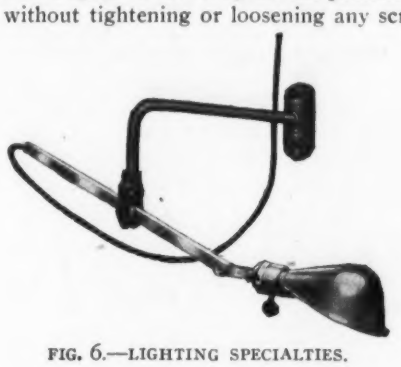
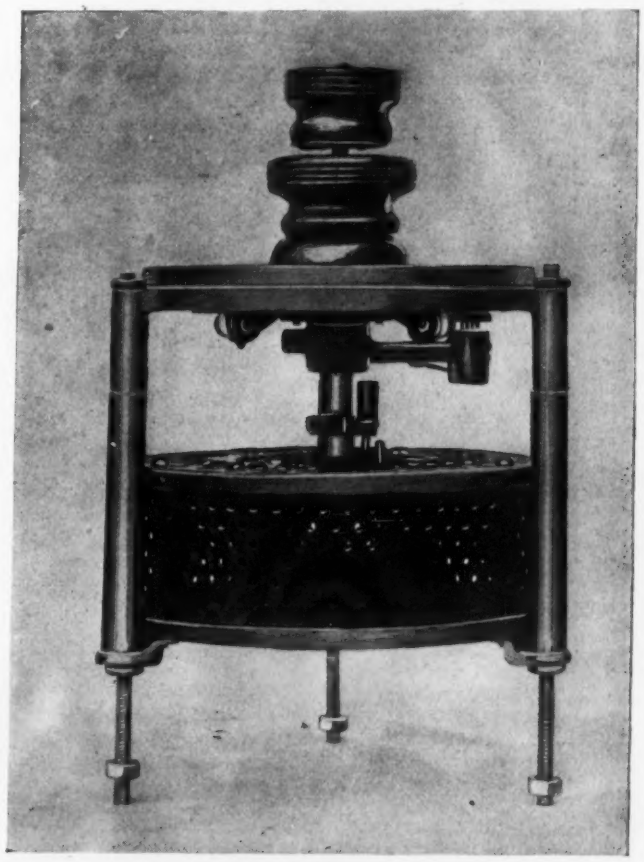


FIG. 6.—LIGHTING SPECIALTIES.

fitting. There is an entire absence of single-sided hinges, ball and socket joints or clutch grips, which are apt to loosen up and let the fixture and lamp sag if subjected to the ordinary vibration in a factory.

Concentric Shaft Field Rheostat.

A form of concentric shaft rheostat brought out recently by the Ward Leonard Electric Company, is 8 in. in diameter, and has no fewer than 900 steps for control purposes. There are two rheostat plates, the total resistance of one being equal to the resistance per step of the other. The plates are mounted upon concentric shafts. As will be seen, there are two handles, one



CONCENTRIC SHAFT RHEOSTAT.

of which controls the main rheostat, and the other the second rheostat, which is used to give regulation between the steps of the main member.

The apparatus in the engraving is built up of standard Ward Leonard units. Any of the sizes of plates can be used, however, to obtain any desired resistance and ampere capacity.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports were somewhat irregular, owing to widely differing weather conditions and uneasiness regarding the labor situation. In some sections of the country spring trade is facilitated by satisfactory temperature, but at other points cold and storms retard distribution of seasonable merchandise. Manufacturing plants are not reducing output, statistics for March promising to establish new maximum records in many industries, but the future contains an element of disturbance in the numerous demands for higher wages. Beneath the surface happenings of the week are to be discerned the steady advance of spring trade, the continuance of the immense activity in building, with collateral heavy dealings in all kinds of lumber and material, and the underlying confidence in a heavy year's turnover in all lines. Money is strong and in active demand throughout the country, and railway earnings continue excellent. Favorable reports come from the winter wheat belt, assuring safety of the plant. Crop reports from all sections are satisfactory and preparations are being made for active planting. Few important price changes are noted, and maintained. Strength is a notable feature. Grain is steady and wheat and corn are a shade higher. All signs indicate heavy expenditure for building material, exceeding that of last year, which, according to the investigations of a prominent mercantile agency, aggregated $750,000,000. Lumber is active and high in price and there is a brisk demand in hardware all over the country. The strength of prices in most industrial lines is marked. Continued heavy buying of steel rails by railway and traction interests was the chief feature of the iron and steel markets, one order, that of 50,000 tons for the Grand Trunk Pacific Railroad, being most notable because of its source. Altogether, it is probable that orders for 150,000 tons of rails were booked within the week, and it is said that more business is pending. Contracts for structural material, though made up of small lots, for the most part, make a goodly aggregate. Coal and coke, owing to the troubled labor situation, are higher in price. Copper was active among sellers of domestic lake, electrolytic and casting stock. There were several large transactions for account of makers of electrical apparatus, and during the latter half of the week the volume of trading was heavy both for home and foreign account. The domestic and foreign wire drawers report work to the full capacities of their plants for a long period ahead, and in this country there is not an electrical apparatus firm or corporation that is not far behind in orders for power, lighting and telephone apparatus. Inability to get copper wire and ingots is greatly hindering the expansion of electric railway, lighting and telephone interests in the United States, Great Britain and Canada. Prices are firm at 18⅝c. to 18¾c. for lake, 18½c. to 18⅝c. for electrolytic, and 18c. to 18¼c. for prime casting grades. Aluminum is quoted at 35c. for No. 1 ingots. *Bradstreet* reports 169 business failures during the week ending March 29, as compared with 170 the previous week and 227 in the corresponding week last year.

SALES OF BALL ENGINES.—The Ball Engine Company, of Erie, Pa., reports the following recent sales: Atlanta Steel Hoop Co., Atlanta, Ga., one 150-hp single cylinder engine; Salt Lake Hardware Co., Salt Lake City, Utah, one 200-hp single cylinder engine; Union National Bank, Pittsburg, Pa., two 320-hp tandem compound engines, one 150-hp single cylinder engine; Cudahy Packing Co., Philadelphia, Pa., one 70-hp single cylinder engine; Pennsylvania Steel Co., Steelton, Pa., three 550-hp single cylinder engines; Massachusetts Cotton Mills, Lowell, Mass., one 500-hp single cylinder engine; Metropolitan Laundry, San Francisco, Cal., two 300-hp tandem compound engines; Edison Electric Illuminating Co., West Chester, Pa., one 400-hp Corliss engine; Hotel Savoy, Kansas City, Mo., one 175-hp tandem compound engine; First National Bank Building, Chicago, Ill., one 350-hp vertical cross compound engine; Pittsburg Plate Glass Co., Pittsburg, Pa., two 200-hp simple engines; Kilby Mfg. Co., Cleveland, O., one 300-hp single cylinder engine, one 200-hp single cylinder engine; Milwaukee Coke & Gas Co., Milwaukee, Wis., one 550-hp single cylinder engine; Grand Rapids Railway Co., Grand Rapids, Mich., two 150-hp engines; Wolvin Building, Duluth, Minn., one 150-hp single cylinder engine; New River & Pocahontas Coal Co., Gentry, W. Va., two 750-hp cross-compound engines; Negeler Bros., Danville, Ill., one 550-hp four-valve Corliss engine, one 400-hp four valve Corliss engine.

FEBRUARY FOREIGN TRADE.—Two-thirds of the fiscal year ending June 30, 1906, has presented its commercial record, and the growth of trade has been sufficient to justify the assertion that for the year both imports and exports will exceed those of any earlier like period. The exports of 1905 exceed those of any earlier year; yet the exports of that part of the fiscal year 1906 recorded are 190 million dollars in excess of those of the corresponding months of 1905. The imports of 1905 were also greater than in any earlier year, yet the import figures for the eight months ending with February, 1906, are 71 millon dollars greater than those of the corresponding period of last year. This growth in imports and exports is shown in detail in a statement just issued by the Department of Commerce and Labor through its Bureau of Statistics. It shows in exports a growth of $190,000,000, manufactures being $45,000,000 in excess and agricultural products $133,000,000 in excess of the total for the corresponding period of last year. Iron and steel manufactured exports showed an increase of $16,000,000.

CENTRAL LABORATORY SUPPLY.—The articles of incorporation of Central Laboratory Supply Company, of Lafayette, Ind., have been filed with the Secretary of State of Indiana. The company is capitalized at $50,000 to manufacture electrical, mechanical, and physical apparatus and machinery. The incorporators are J. W. Esterline, W. D. Pence, E. S. Ferry, W. Bent Wilson, S. C. Lank, C. C. Pyke, Geo. W. Switzer, W. J. Esterline. The present officers of the company are W. Bent Wilson, president; S. C. Lank, secretary, and Geo. W. Switzer, treasurer. The company has just issued the following bulletins: No. 102 describing its transmission dynamometer; No. 103 on direct reading magnetic testing apparatus; No. 105, terminal boards for testing rooms and experimental laboratories; No. 106, alternating current generators.

FOREIGN ELECTRIC CONTRACTS of a large size have recently been secured by the Westinghouse interests, aggregating $2,000,000. One of the principal contracts is that placed by the South Wales Electric Power Distribution Company, which plans to generate electric energy to operate a number of big Welsh iron, steel, and a tin-plate works. The London County Council has let an order worth about $250,000 for motor equipment for the electric cars to be run on the lines now being converted from horse to electric motive power in the northern part of London. The South African orders include one for electric machinery for the Rand water works.

ST. PAUL POWER PLANT.—Claussen, Burch and Pillsbury, consulting engineers, Minneapolis and St. Paul, have issued specifications for a new steam power plant for the West Side Power, Light & Heat Company, St. Paul, Minn. It will ultimately include four 400-hp boilers, with mechanical stokers, fuel economizers, induced draft system, three 540-hp engines or turbines, three 300-kw alternators, switchboards and induction motors. Plans will be prepared later for a fireproof building for the plant The cost complete is $100,000.

MORE ESCALATORS.—The Siegel Cooper Company of New York City has contracted with the Otis Elevator Company for two additional electric escalators. These new machines will be located respectively between the third and fourth and fourth and fifth floors. The first escalator placed in the Siegel Cooper store was installed several years ago, and the recent contract serves to indicate the satisfactory service rendered by the original machine.

CANADIAN PACIFIC TELEGRAPHS.—General Manager McNicoll, of the Canadian Pacific Railway, announces that the Canadian Pacific telegraph department the coming summer will construct 610 miles of new pole lines and 4,068 miles of wire, of which 1,966 will be copper. The system is already complete within itself from Halifax to Vancouver.

ORDERS FOR GENERATORS.—The B. F. Sturtevant Co., of Boston, Mass., has recently received orders for generating sets from A. M. Lockett & Co., Ltd., Alta Loma, Tex., and the Post Pipe Co., Texarkana, Tex.

EXTENSIONS TO THE WEST ALLIS WORKS.—The new extensions to the West Allis, Milwaukee, works of the Allis-Chalmers Company, which, when completed, will add 861,000 sq. ft. to the plant's present floor area of 652,000 sq. ft. and make the entire plant capable of affording employment to 11,000 persons, will place the West Allis works among the largest industrial plants of the country. The extended works, together with the capacities of the other works of the company in Milwaukee, Chicago, Cincinnati and Scranton, will be capable of affording employment to a total of approximately 18,000 persons. The extensions built are as follows: Three machine shops running east and west, parallel to the existing units, Nos. 1, 2 and 3, each 575 ft. long and 145 ft. wide for units Nos. 1 and 2 and 168 ft. wide for No. 3; an erecting shop, 1,136 ft. by 113 ft., running north and south as an extension of the existing erecting shop and adjoining the six machine shop units opening out into it; the extension of the existing foundry, north and south, which has a total length of 994 ft. over all and a width of 222 ft. and the extension of the pattern and pattern storage building which also has a length of 994 ft. over all and a width of 119 ft. The work of constructing these extensions involves an expenditure of over $3,000,000. The West Allis site, situated in the town of West Allis, on the outskirts of Milwaukee, has a frontage of 1,575 ft. and runs back 2,696 ft. The general plan of the West Allis works provides for two sets of building units, one composed of those in which the work is common to every class of product, like the pattern shops, erecting shops and foundry; the other group comprising the machine shop units where the work is specialized for various machine operations. The two groups of buildings lie at right angles to each other; those of general utility lengthwise of the plat, north and south. The machine shops, six units in all, run crosswise of the plat, adjoining the erecting shop at the east end. Facing the ends of the machine shop units Nos. 1 to 6, stands the foundry with its extensions, extending north and south. The pattern storage and shops stand farthest westward in the group and parallel to the foundry, with a span of 98 ft. between them. In connection with the building of these extensions it may be interesting to note that 19,000 bbls. of Portland cement are used for concrete work; seven million bricks go into the building of walls; 785,000 ft. of roof sheathing will help cover the shops and 850,000 ft. of yellow pine and white oak flooring will serve to support the massive equipment to be installed. Over 3½ acres of wire glass will be used for skylights and windows, while the new equipment for the various extensions will aggregate 3,080 tons.

NORTHERN CALIFORNIA POWER.—At the recent annual meeting in San Francisco of the Northern California Power Company, President H. H. Noble in his report showed that the company was in a flourishing condition. The company has been able to dispose of all of its developed power and is now making arrangements to double the capacity of its Volta plant, the work to be completed by December 1. Power is supplied to the smelting plant of the Mountain Copper Company and for gold dredgers at Horsetown. Twelve miles of line have been built from Orland to Hamilton to supply a large beet sugar factory. A new line 16 miles long has been built from De La Mar to Kennett, tying the two power plants together in another place. A contract for twenty years has been made with the Valley Counties Power Company, a subsidiary company of the California Gas & Electric Corporation, to deliver to it optionally 5,000 hp at Chico at 60,000 volts. This contract places the Northern California Power Company in the unique position of never having any power going to waste, as by the terms of the contract it can use it any portion of the time for its own customers, and any not being so used will be taken by the Valley Company. In order to do this it was necessary to build a new high-tension line from the Volta power house to Chico, erecting a large transformer station at Volta to raise the line voltage to 60,000 volts, and another transformer station at Molinos, where transformers will be installed to step down from 60,000 to 20,000 volts, tying the lines in with the old system at that point and insuring better service to the central portion of the territory. This work is being done by the Battle Creek Power Company, whose stock will be owned entirely by the Northern California Power Company. The Battle Creek company has secured water rights on Battle Creek capable of developing 10,000 hp. The company has made a very favorable contract with the Reading & Red Bluff Railway Company to supply it with all of its power for a term of 25 years, and from present indications construction work will be commenced within the very near future. From a point on the main line about two miles above Keswick a branch line has been built over into the Old Diggings district, where the company is now supplying two mines with power. The company's financial statement shows total assets of $1,777,016. The gross earnings for the year were $185,024, and total expenditures $113,549, leaving a balance of $7,475. Twelve dividends of $5,000 each were paid, or 10 per cent on the capital stock of $600,000. The surplus for the twelve months was $15,414, bringing the total surplus up to $131,596. The business for the year showed an increase of $6,452.

A NIAGARA POWER FIGHT.—According to a dispatch from Albany, the Niagara, Lockport & Ontario Power Company and the Niagara County Irrigation & Water Supply Company are preparing to wage war against the Foelker bills putting them out of business. The bills have been introduced in the Legislature and repeal outright the charters of these two companies. The Niagara, Lockport & Ontario Company's charter calls for unlimited water rights in Niagara River, while the Niagara County Irrigation & Water Supply Company has unlimited water power rights in the same water course for 50 years, beginning with 1891. The bills have been sent to the Assembly Judiciary Committee, with four bills formally repealing the charters of four Niagara power companies which did not avail themselves of their rights within the time limit. There is no fight on these four bills. The Niagara, Lockport & Ontario Power Company's charter has not yet taken any water from Niagara River, but it is acting as the transmission company for one of the Canadian power companies. It has already spent much money in building transmission lines in Niagara and other Western New York counties. All the power of land condemnation and other rights necessary to build a transmission line under which the company has been acting have been derived from the charter which Mr. Foelker now seeks to repeal.

DEVELOPMENT IN PITTSBURG.—The Electrical Equipment & Supply Company, of Pittsburg, has moved this week into larger quarters in that city, and is now occupying 341 Second Avenue. A number of new specialties have been added to its lines, and the price list is revised. The stock has been largely increased, and the capital invested multiplied by three. Mr. Thos. Watson has retired from the vice-presidency, being succeeded by Mr. J. McPrice, late manager of sales. Mr. C. G. Hussey has retired from the treasurership, his successor being Mr. F. S. Kaulback. The directors of the company are now these with Messrs. W. H. Waugh, R. T. Reineman, and J. H. Waugh.

LARGE WESTINGHOUSE ORDERS.—The Westinghouse Electric & Manufacturing Company has received through its Atlanta office a very large order for electric machinery from the Southern Power Company, Fort Lawn, S. C. The order includes eight 3000-kw., 3-phase, 2200-volt, 60-cycle generators for direct connection to water wheels and to operate at a speed of 225 r.p.m.; two 250-volt exciters, and twelve 2000-kw, oil-insulated, water-cooled transformers. Through the Philadelphia office an order has been received from the Wilkesbarre & Hazleton Railway for two turbine-type generators of 1,000 kw capacity, 3-phase, 25 cycles, to operate at 300 volts.

CENTRAL STATION DIESEL ENGINES.—Mr. W. A. Whittlesey, treasurer of the Pittsfield, Mass., Electric Company, writes us: "We have placed an order for two 225-hp American Diesel engines, and delivery is contracted for August 1st next. We plan to direct connect these two engines to one 350-kw, alternating-current generator by means of magnetic clutches. We have, for over a year, been investigating the merits of this type of engine, and have satisfied ourselves, by personal visits and by correspondence with those using the engines, that they are economical and are reliable. We do not expect to purchase any more steam engines."

DUTY ON SCARF PINS.—General Appraiser Sharretts has written a decision for the Board of Appraisers in which it was held that electric scarf pins must pay duty as "jewelry," at the rate of 60 per cent. Austin Baldwin & Co., the importers, took the position that the merchandise should be admitted at only 45 per cent, on the plea that the pins were dutiable under the provision in the tariff law for "manufactures of metal."

GENERAL VEHICLE COMPANY.—We are advised that this company is the successor to the Vehicle Equipment Company, and that the manufacture of electric automobiles and other types, chiefly for industrial purposes, will be continued at the Long Island City shops.

IMPROVEMENTS IN HELENA.—A contract has been made between J. G. White & Co. and the Helena Light & Railway Company, of Helena, Mont., whereby the former company will undertake the reconstruction of the properties of the latter for $140,000. On September 11, 1905, the public service utilities of Helena were bought, reorganized and consolidated under the holding corporation known as the Helena Electric Light & Railway Company. The amount involved in the transaction was $2,350,000, which covered electric railway, electric light and gas lighting properties. Responsibility for operation was delegated by the corporation to the operating department of J. G. White & Co. During the month of February, 1906, the traffic on the railway was nearly quadruple that of the corresponding month of 1905, and the proceeds from the lighting service were also very materially augmented. Electric power is supplied the Helena Light & Railway Company by the Missouri River Power Company, and the organizations are united in the ownership of the central sub-station, from which power is distributed for the public service. The agreement for power calls for a rate at maximum of utilization of $25 per hp-year. Owing to the fact that the maximum is not at present utilized there is a large margin for increase of consumption by the light and railway company without increase of operating expense. There are about 18 miles of track in the railway system, a great deal of which will be reconstructed under the provisions of the contract just signed. Before the reorganization the annual income from the railway property was about $62,000, and from the lighting property, both gas and electric, about $151,000. The combined operating expenses were about $143,000, making the ratio of operating expense to gross receipts 67 per cent. A careful estimate of operating conditions after the contemplated improvement places the gross receipts at $255,000 and the operating expenses at $147,000, this reducing the ratio to 57 per cent. The estimate for improvement includes $115,000 to be devoted to reconstruction and extension in general, and $25,000 for the relaying of tracks and replacement of overhead construction on Main Street in Helena.

NEW YORK SAFETY STEAM POWER.—At the annual meeting of the stockholders of the Nichols & Langworthy Machine Company held at Hope Valley, on March 28, 1906, the officers and directors, who, with one or two exceptions, have been continuously in the management of the business since 1869, retired, and the following officers and directors were elected: Ernest J. Jochen, president; Willis G. Nichols, vice-president; John Stewart Thomson, treasurer; Ernest J. Crandall, secretary. These officers, together with James R. Burnet, counsel of the company, constitute the board of directors. At a meeting of the directors of the New York Safety Steam Power Company, which is controlled by the Nichols & Langworthy Machine Company, held on the same day, the following officers were elected: Ernest J. Jochen, president; John Stewart Thomson, treasurer; J. M. W. Shepherd, secretary. The retiring officers, Henry Clay Nichols and Albert L. Chester, retain a substantial interest in the business. The Nichols & Langworthy Machine Company also voted an issue of $125,000 of its first mortgage bonds secured by a mortgage or deed of trust to the Industrial Trust Company, of Providence, R. I., the proceeds to be used for additions and extensions to the existing plant, which is to be enlarged and improved. The present business was established in 1820, and has maintained a high reputation in the manufacture and sale of engines and boilers.

ELECTRIC RAILWAY EQUIPMENT.—In pursuance of its plans for electrifying the Camden and Atlantic City line, the West Jersey & Seashore Railroad has ordered ten General Electric 69 (200 hp) double-motor equipments with the Sprague-General Electric type and control. These motors with their controlling apparatus are duplicates of fifty-eight equipments previously ordered for this electrification project. Another company which has recently increased its rolling stock is the Brooklyn Rapid Transit Company, which has added 200 General Electric 80 (40 hp) motor equipments. Twenty-five four-motor General Electric 54 (35 hp) equipments have been ordered by the Rochester Street Railway Company. The power station of the International Railway Company, Buffalo, N. Y., is being enlarged to meet the demand of the increased power for railway work. Two 1,000-kw, 25-cycle, three-phase rotary converters, complete with transformers, switchboards, etc., have been ordered from the General Electric Company for this purpose. These make a total of three such rotary converters used in this power station.

STEAM TURBINE FOR SIAM.—One of the most progressive of the independent principalities of Asia is the Kingdom of Siam on the Indo-Chinese Peninsula. In the principal city, Bangkok, is an electric railway power plant, operated by the Siam Electricity Company, and equipped with reciprocating engines and generators. Because of the increased demand for power an additional unit has become necessary, and a Curtis steam turbine has been selected. This is a 500-kw, 575-volt machine, built by the General Electric Company at Schenectady. The boiler plant for this station is unique in that paddy husks are burned in place of coal. The fuel is brought down the river from the rice fields in flat-bottomed boats to the power house and unloaded directly into the boiler room by an elevator and belt conveyor, built by the Link-Belt Engineering Company, and operated by several direct-current, 500-volt General Electric Company motors. This method of using rice husks for fuel is an economic utilization of a waste product similar to the use of the crushed sugar cane, or bagasse, on sugar plantations.

WESTINGHOUSE-FINZI IN ITALY.—We are advised by the well-known Finzi firm, of Milan, Italy, that a combination was effected last month between the Officine Elettro-Ferroviarie, with a capital of $7,500,000, and the Societe Anonyme Westinghouse, of Paris, with a capital of $5,000,000. Under this alliance or working arrangement, electrical installations will be carried out by the two organizations together. The installation of single-phase electric railways will bear the name Westinghouse-Finzi, under the patents of the Westinghouse Company and of Dr. George Finzi, who was the pioneer in Italy of the use of single-phase motors in traction. Dr. Finzi is at the head of the Officine Elettro-Ferroviarie, which has been erecting large factories at San Christoforo, near Milan. This new alliance is regarded in Italy as one of great significance, coming as it does at the moment of Italy's industrial renaissance, and at a time when electric railways, particularly those of the single-phase type, are making so deep an impression on the railroad industry.

ALLIS-CHALMERS IN CHICAGO.—Pettibone, Mulliken & Co., of Chicago, will install two new Allis-Chalmers cross-compound engines recently purchased from the Allis-Chalmers Company, Milwaukee. The new outfit consists of an 18-in. and 36-in. by 42-in. and 24-in. and 48-in. by 48-in. Reynolds heavy-duty, cross-compound Corliss unit. Swift & Co., of Chicago, purchased recently through the Chicago office of the Allis-Chalmers Company two 800-kw, 250-volt generators, 120 r.p.m., which will be built at the company's "Bullock" works, Cincinnati. The A. H. Andrews Company, of Chicago, is a recent purchaser of a 115-kw Allis-Chalmers alternator, wound for two-phase, 60 cycles, 440 volts, and a 4-kw, 120-volt belted exciter, to be used in conjunction with other units for light and power purposes. This apparatus will be built at the company's "Bullock" works, Cincinnati.

LIGHTING IN COSTA RICA.—Mr. W. F. Teller, P. O. Box 41, San Jose de Costa Rica, Central America, writes us that he has received the contract to light the city of Puntareanes, Costa Rica, with 45 arcs of 6.6 amp., 72 volts at the arc. He has the exclusive rights for 20 years for arc and incandescent lighting, the arcs at $9.30 per month and the incandescents at $1.40 per month for lamps of 16 cp. The plant will be run by steam using sea water for cooling the surface condensers.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., has been awarded through Takata & Co., of Wall Street, New York, the contract for furnishing 16,000 insulators to the Tokio Tramways in Japan. These insulators are the 15-in. type, constructed in four pieces and of 60,000 volts capacity. They are to be furnished complete with steel pins. This order is particularly gratifying as the contracts for most of the equipment of this road went to European manufacturers.

Financial Intelligence.

THE WEEK IN WALL STREET.—Prices of stocks suffered moderate declines on the announcement of an anthracite coal miners' strike, but rallied on support by large interests. Transactions were somewhat larger and general and advances were scored in various parts of the list. The United States Steel stocks improved at first with the general market, but the fear that a bituminous coal strike would have an adverse effect on the operation of its plant seemed to impose a check on bullishness in these issues. Electrics and tractions were stronger and all closed at advanced quotations. Allis-Chalmers common made a net gain of ⅞ point, closing at 22, and preferred ½, the closing

quotation being 58½. General Electric closed at 172¼, which is an advance of 3¾ points. Brooklyn Rapid Transit gained 5⅜ points, the closing quotation being 88⅜. The number of shares sold was 208,200. Metropolitan Street Railway, on a small business, advanced from 112 to 116, which latter was the last quotation, and a net gain of 4 points. United States Steel common closed at 41¾, a net advance of 1⅞, and preferred at 107¼, a gain of 1⅝. American Locomotive common and preferred are quoted at 69 and 115½, respectively, and Western Union closed at 92¼, which represents a decline of ¼ point. The last quotation of American Telephone & Telegraph was 138¾, a gain of ¼. The curb market was heavy and irregular during much of the week, with a small volume of business. Later there were partial recoveries, and transactions were on a larger scale. There were few features. Interborough-Metropolitan issues enjoyed a little spurt late in the week and closed at 53 for common and 90⅞ for 4½s, these prices being net gains of 1⅝ and ⅜ points, respectively. Mackay Companies closed at 61, this being an advance of 1½ points. The closing quotations on the stock market April 3 are given below:

NEW YORK

	Mar. 27	Apr. 3		Mar. 27	Apr. 3
Allis-Chalmers Co.	21⅛	22⅜	General Electric	167	173
Allis.Chalmers Co. pfd.	57	59	Hudson River Tel.	...	...
American Dist. Tel.	30	30	Interborough Rap. Tran.	228	222
American Locomotive	68	70¼	Mackay Cos.	59⅝	62⅛
American Locomotive pfd.	115	115	Mackay Cos pfd.	72⅛	73
American Tel. & Cable	92	92	Marconi Tel.	...	...
American Tel. & Tel.	138	137¾	Metropolitan St. ay	113	118
Brooklyn Rapid Transit	84	88⅜	N. Y. & N. J. Tel.	...	...
Electric Boat	27	27	Western Union Tel	92	91¼
Electric Boat pfd	65	65	Westinghouse com.	158	160
Electric Vehicle	12	12	Westinghouse pfd.	...	...
Electric Vehicle pfd.	15	15			

BOSTON

	Mar. 27	Apr. 3		Mar. 27	Apr. 3
American Tel. & Tel.	138⅛	138⅛	Mass. Elec. Ry. pfd	69	68
Cumberland Telephone	...	...	Mexican Telephone	4⅛	4⅛
Edison Elec. Illum.	247½	248	New England Telephone	139	140½
General Electric	167⅜	173⅛	Western Tel. & Tel.	...	13⅜
Mass. Elec. Ry.	19⅛	19⅛	Western Tel. & Tel. pfd.	...	90

PHILADELPHIA

	Mar. 27	Apr. 3		Mar. 27	Apr. 3
American Railways	51	52	Phila. Electric	7⅞	8
Elec. Co. of America	11¼	11¼	Phila. Rapid Trans.	27⅝	29
Elec. Storage Battery	78	78	Phila. Traction	99¼	99¼
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Mar. 27	Apr. 3†		Mar. 27	Apr. 3†
Chicago City Ry.	155	...	National Carbon.	86	...
Chicago Edison	148¾	...	National Carbon pfd.	118	...
Chicago Subway	49	...	Union Traction	...	...
Chicago Tel. Co.	117	...	Union Traction pfd	...	...
Metropolitan Elev. com.	26⅛	...			

† Election Day

DIVIDENDS.—The Manchester Traction Light & Power Company has declared a regular quarterly dividend of 1½ per cent, payable April 16. Directors of New Orleans Railway have declared the regular quarterly dividend of 1¼ per cent on preferred stock, payable April 14. The directors of the Chicago Pneumatic Tool Company have declared the regular quarterly dividend of 1 per cent, payable April 25. Directors of the E. W. Bliss Company have declared the regular quarterly dividend of 2½ per cent on the common stock and 2 per cent on the preferred stock, payable after April 2. The directors of the United Railways Investment Company of San Francisco have declared a dividend of 4¾ per cent on the preferred stock, payable on May 1. By this declaration, all cumulative dividends in arrears on the preferred stock at the rate of 5 per cent per annum are paid up to September 30, 1905. The directors of the New York & New Jersey Telegraph Company have declared the regular quarterly dividend of 1½ per cent, payable April 14. The Nebraska Telephone Company, of which the American Telephone & Telegraph Company owns 58.33 per cent, has declared a regularly quarterly dividend of 1½ per cent, payable April 10. The Pacific States Telephone & Telegraph Company, of which 50.1 per cent is owned by the American Telephone & Telegraph Company, has declared a regular quarterly dividend of 1¾ per cent, payable April 15. Directors of the United Railways Company of St. Louis have declared the regular 1¼ per cent preferred quarterly dividend, payable April 10. The Philadelphia Company directors have declared the regular quarterly dividend of 1½ per cent on the common stock, payable May 1.

STEAM AND TROLLEY.—Official notice has been given by the New York, New Haven & Hartford Railroad Company that the corporation offers to exchange one share of its capital stock for each $200 face value 4 per cent debenture of the Consolidated Railway Company of the issues of January 1, 1904, and January 2, 1905. The Consolidated Railway Company is the holding company of the larger corporation for the street railway system of the latter company. The offer will be open and exchange may be effected between May 1, 1906, and July 1, 1906, with exchange of accrued interest on the debentures for accrued dividends on the stock. Provision is made for the exchanges in New Haven, Boston and New York, and new stock certificates will be issued as soon after May 1 as is practicable. The outstanding Consolidated Railway debentures affected by that plan and in the hands of the public amount to between $7,000,000 and $8,000,000, which, if all are exchanged, will add about half that sum to the capital stock of the New Haven Steam Company. The proposed exchange of stock is of considerable importance, as being a new assumption of the holding company's liabilities by the parent steam corporation and suggesting a step toward the ultimate merger of the steam and electric railway companies.

FRANCHISE VALUATIONS INCREASED IN NEW YORK.—The final valuation for the current year of special franchises operated in New York City as announced by the State Board of Tax Commissioners shows an increase of $59,301,250, equal to approximately 20 per cent over the valuation of the year previous. The total valuation is placed at $361,479,300, against $302,178,050 for 1905. The valuations of the franchises of the companies entering into the Interborough-Metropolitan Company, as placed by the board, as compared with 1905, are as follows:

	1906.	1905.		Changes.
N. Y. City Ry. System	$79,470,000	$79,233,000	Inc.	$237,000
Manhattan Ry. Co.	62,700,000	59,700,000	Inc.	3,000,000
Interborough R. T. System	18,000,000	9,000,000	Inc.	9,000,000
Total	$160,170,000	$147,933,000		$12,237,000

The total percentage of increase is 8.25 per cent. The valuations of franchises of other of the large corporations compare as follows:

	1906.	1905.		Changes.
B. R. T. System	38,479,000	29,560,000	Inc.	8,919,000
Consolidated Gas Co.	82,921,000	69,710,000	Inc.	13,211,000
Brooklyn Un. Gas Co.	16,495,000	13,194,500	Inc.	3,300,500
N. Y. Telep. Co.	17,078,000	6,610,000	Inc.	10,468,000

ST. LOUIS TROLLEY MERGER.—A merger of traction lines in St. Louis is proposed by E. W. Clark & Co., of Philadelphia, who have prepared to manage the new system. Stockholders of the East St. Louis & Suburban Company and of the Alton, Granite & St. Louis Traction Company have been invited to deposit their stock under the merger plan before April 10, receiving in exchange stock in a new holding company, to be incorporated in New Jersey, with a capitalization of $14,000,000, of which one-half will be preferred stock. All but $425,000 of the new preferred and $360,000 of the new common will be paid in exchange for the stock of the traction companies. This stock Clark & Co. offer to buy at $425,000, paying cash to that amount into the treasury of the holding company, which will serve as working capital. The East St. Louis & Suburban Company is capitalized at $5,000,000. The Alton, Granite & St. Louis Traction Company has outstanding $500,000 of preferred and $2,150,000 of common stock. An extension between Alton and East St. Louis, which will be put in operation this year, is expected to add materially to the earnings available to the holding company.

NEW YORK ELECTRIC CABS.—At the stockholders' meeting of the New York Transportation Company the president of the company said in part: "The company is getting on its feet. Last year a moderate net surplus was shown." Replying to a question put by a stockholder as to how much salary the president was drawing it was stated that he gets $10,000 a year. H. P. Whitney was elected in the place of Samuel E. Morrow at the stockholders' meeting, and also Charles M. March in place of Arthur K. Wing. The other directors were re-elected. The electric cabs and hansoms of the company have been in large demand all winter and the open season has been very favorable for low operating expenses.

CHICAGO TELEPHONY.—A special dispatch from Chicago states that the Illinois Manufacturers' Association has decided to incorporate a $9,000,000 telephone company, which can be equipped within two years, or one year before the Chicago Telephone Company franchise expires. The rates offered the city include three-cent public calls and are 10 to 30 per cent below prices set by the existing company in its last reduction.

LONDON UNDERGROUND.—In London, on April 3, an extraordinary meeting of the shareholders of the Underground Electrical Railways under the presidency of Edgar Speyer, authorized the directors to raise $25,000,000 additional capital required for the purposes of the company.

ILLINOIS TROLLEY NETWORK.—A special dispatch from Chicago quotes James S. Hopkins, attorney for the Aurora, Elgin & Chicago, as authority for the report that 541 miles of Wisconsin and Illinois electric lines merged this week by Cleveland capitalists with capital of $20,000,000, will be taken over by the Aurora-Elgin combination recently effected by the Mandelbaum syndicate. With lines already in operation or contracted for the company will reach as far west as Dubuque, Ia., and as far north as Madison, Wis., and that it is planned to get into St. Louis. Working arrangements will be made with lines from Chicago through Indianapolis to Cincinnati. Mr. Hopkins says many connections will have to be built to complete this plan. The following lines are said to be included in the merger, aside from the three subsidiary lines of the Aurora, Elgin & Chicago; Elgin & Belvidere; Belvidere, Rockford & Freeport; Rockford, Beloit & Janesville; Janesville & Madison; Geneva & Freeport; Aurora & De Kalb; Aurora, Plainfield & Joliet; Yorkville & Plano; Carpentersville & Crystal Lake; Freeport & Dubuque. A possible later acquisition is the Chicago, Kenosha & Milwaukee Electric Railway. The syndicate has entrance to Chicago over the Metropolitan West Side Elevated.

TRI-CITY BONDS.—The bonds of the Tri-City Railway & Light Company to the amount of $6,000,000 are being offered by N. W. Halsey & Co. and Mackay & Co. They bear 5 per cent and may be redeemed at the option of the company on any interest date at 105 and accrued interest. A sinking fund provision will provide for the retirement of $2,250,000 of the bonds at maturity. The total authorized issue is $9,000,000, and $464,000 is reserved for the retirement of a like amount of underlying bonds maturing annually up to 1911, and $2,536,000 is reserved for additions and improvements. This issue is secured on practically all of the stocks and bonds of the public service corporations in Davenport, Ia.; Rock Island, Ill.; Moline, Ill., and East Moline. The plans of the companies in the consolidation are to be remodelled by J. G. White & Co. Of the bonds now coming on the market $2,000,000 are taken by local investors in Iowa and Illinois, and it is said that the larger part remaining has already been sold.

WESTERN TELEPHONE.—The Western Telephone & Telegraph Company, in its report for the year ended January 31, makes the following exhibit:

	1906.	1905.	Increase.
Gross earnings	$1,464,842	$1,408,215	$56,627
Operating expenses	577,415	533,123	44,292
Net earnings	$887,427	$875,092	$12,335
Dividends	800,000	800,000	.....
Surplus	$87,427	$75,092	$12,335

The companies included in the Western are the Cleveland Telephone Company, Northwestern Telephone Exchange Company, Southwestern Telegraph & Telephone Company, and the Wisconsin Telephone Company.

SOUTHERN N. E. TELEPHONE.—At New Haven, Conn., on March 27, the board of directors of the Southern New England Telephone Company decided to issue $500,000 worth of new stock of the $10,000,000 issue that was voted in January. The other $500,000 will be issued about October of this year, making the present stock issue $6,000,000. The Legislature has authorized the company to issue up to $10,000,000. It was voted by the directors that stockholders would have to pay $120 a share for the new stock, although the par value is only $100. This is said to be the first time that a public service corporation in Connecticut has made its stockholders pay more than par for new stock.

VEHICLE EQUIPMENT RECEIVERSHIP.—As the result of a petition in involuntary bankruptcy a receiver has been appointed for the Vehicle Equipment Company, of Long Island City, of which Robert McA. Lloyd is president, Hector A. Havemeyer vice-president, and Arthur H. Havemeyer, a son of William F. Havemeyer, secretary. The company was incorporated under New Jersey laws in December, 1900, with a capital stock of $400,000, which has since been increased to $3,000,000, of which $2,000,000 is common and $1,000,000 preferred. There is also a bond issue of $1,000,000. The petition for a receiver declares that the liabilities of the company are from $250,000 to $300,000.

NATIONAL ELECTRIC SALE.—The entire assets of the National Electric Company, of Milwaukee, were bought on March 26 for $500,000 by Mr. C. L. Sullivan, of Chicago, president of the Sullivan Machinery Company, of that city, acting in behalf, it is said, of Westinghouse interests. Mr. John I. Beggs was the receiver and trustee and stated at the sale that there were orders on hand amounting to $37,528. The assets amounted to $1,350,691 and the liabilities to $1,242,000. Objections to the sale and its confirmation have been made by Mr. N. A. Christensen, one of the large creditors. Some of the above details were noted briefly last week.

LA CROSSE WATER POWER.—The La Crosse Hydro-Electric Light & Power Company, organized a few months ago with $1,000,000 capital to transmit current from Black River Falls to La Crosse, 50 miles, has increased its capital to $5,000,000. Mr. Samuel Insull, president of the Chicago Edison Company, has been elected president. The other officers are E. G. Boynton, La Crosse, vice-president, and Orlando Holmey, La Crosse, secretary. The name of the new company is the La Crosse Water Power Company. Work has begun on a dam that will give a head of 90 ft.

NORTHWESTERN KANSAS SCHEME.—Advices from Topeka state that there is a plan on foot in southeastern Kansas to connect all of the cities in that locality by an interurban system, to cost $4,000,000. This is in the oil, gas and mining regions. The power houses will be in the natural gas cities. W. D. Egolf, of Kansas City, and E. H. Abadie & Co., of St. Louis, are among the promoters. Mr. Abadie is well known in the electrical field through his former connection with the Wagner Electric and other interests.

KANSAS CITY EARNINGS.—Large gains are shown below by the Kansas City Railway & Light Company:

	1906.	1905.	
February gross	$385,019	$310,503	Inc. $74,516
Expenses and taxes	245,069	215,557	Inc. 29,512
February net	$139,950	$94,946	Inc. $45,004
Nine months' gross	3,850,206	3,267,490	Inc. 582,716
Expenses and taxes	2,204,931	1,888,893	Inc. 316,038
Nine months' net	$1,645,275	$1,378,597	Inc. $266,678

CANADIAN WESTINGHOUSE.—The Canadian Westinghouse Company's profit and loss account for the year ending December 31, 1905, is as follows:

Net earnings for 1905	$220,545
Previous surplus	160,596
Total	$381,141
Dividends paid for year	149,100
Profit and loss surplus Dec. 31, 1905	$232,041

CONSOLIDATION IN PENNSYLVANIA.—The Union Heat & Light Company, of Grove City, has transferred its franchises and lines to a syndicate of Franklin and Pittsburg capitalists, with ex-Judge S. S. Mehard, of Pittsburg, and Senator Lee of Franklin, as the principals. Similar deals have been closed for the gas plants in Stoneboro and Shady Lake. The three towns will be connected with the Anderson field. The price paid for the plant is said to be $75,000.

MEXICAN TELEGRAPH STOCK.—The Mexican Telegraph Company has increased its capital stock from $2,000,000 to $3,000,000. The directors of the company have declared a stock dividend of 50 per cent on the present outstanding stock. This dividend amounts to $1,000,000 par value of stock as the outstanding stock is $2,000,000. The dividend is declared on account of expenditures made out of earnings for several years up to December 31, 1905.

STANDARD ELECTRIC SUPPLY.—A petition in bankruptcy has been filed against the Standard Electrical Supply Company at 37 Warren Street, New York City, by these creditors: Gerald W. Hart, $858; William Taylor, $9, and Joseph T. Harris, $11. Judge Adams appointed Robert G. Benedict receiver under a $10,000 bond. The assets are estimated at $30,000 and liabilities $40,000.

CHICAGO EDISON.—The City Council has approved the ordinance reducing electric light rates nearly 25 per cent and permitting the consolidation of the Chicago Edison and Commonwealth Electric Companies, the merger to occur within six years. The Arnold-Carroll report on the subject has been noted in these pages.

BUFFALO BELL TELEPHONE reports for the year ending December 31, 1905, gross of $1,400,263, net of $555,118, dividends of $363,000, and a surplus of $192,118, all items showing a gain over 1904. The number of stations was 45,563, as compared with 36,611 in the previous year.

BELL STOCKHOLDERS.—President Fish states there are no fewer than 20,000 stockholders in the American Telephone & Telegraph Company.

KEYSTONE TELEPHONE COMPANY, of Philadelphia, reports a gross of $67,533 for February and $535,042 for eight months, the net being respectively $30,897 and $242,703.

GENERAL NEWS.

Construction News.

ENSLEY, ALA.—The Birmingham Railway, Light & Power Company, of which J. A. Emery is general manager, has decided to build a substation on Ninth Street, Ensley.

PELL CITY, ALA.—The Pell City Manufacturing Company has petitioned the Council for a franchise to furnish electric lighting for the city.

SEWARD, ALASKA.—The Seward Light & Power Company will install a 225-kw Allis-Chalmers water-wheel-type generator, a 9-kw belted exciter and a switchboard, recently ordered in the electric light station at Seward, for lighting and power service. The new outfit will be built at the company's works in Cincinnati, Ohio.

HOLBROOK, ARIZ.—F. W. Nelson is organizing a company for the purpose of constructing a telephone line from this city to Springerville.

DE QUEEN, ARK.—The De Queen Light, Ice & Cold Storage Company has purchased, through the St. Louis office of the Allis-Chalmers Company, a new steam and electric outfit consisting of an 85-kw belted generator wound for single phase, 60-cycles, 1,100 volts and a 35-kw direct-current exciter, both to be driven by a 14x24-in. Reliance engine, at a steam pressure of 100 lbs. The new outfit will be installed at De Queen for the purpose of lighting the city, the owners of the plant being large property holders.

EUREKA SPRINGS, ARK.—The City Council has granted G. U. Matthews and C. M. Barnes an electric light franchise for 99 years.

NAPA, CAL.—N. F. Grigsby has been awarded a franchise to construct and operate a telephone system in Napa County.

YREKA, CAL.—The Sunset Telephone Company is preparing to rebuild the Yreka telephone plant and will expend $5,000.

SAN BERNARDINO, CAL.—The Lytle Creek Power Company has secured a permit to erect a power house on South First Street, between C and D Streets, to cost $1000.

STOCKTON, CAL.—The American River Electric Company, of which B. C. Condit is superintendent, is considering the construction of an auxiliary steam power plant in the Northeastern part of the city.

OAKLAND, CAL.—The Ygnacio Valley Electric Railway Company has filed articles of incorporation, with a capital stock of $2,000,000. L. F. Winchell and L. B. Bishop, of San Francisco, are mentioned in connection with the project.

OAKLAND, CAL.—Reports state that the merchants of this city are strongly in favor of granting a franchise to the Oakland Traction Consolidated Company to operate a street railway along Second and Webster Streets in connection with its Alameda line.

REDWOOD CITY, CAL.—The Board of Supervisors of San Mateo County has granted C. F. Grandon a franchise to lay gas mains and to erect a line of poles and wires for the purpose of supplying gas and electricity to the inhabitants of Pescadero and vicinity.

UKIAH, CAL.—Perry Stanley, a Mendocino electrician, has bonded the water right of Alder Creek, near Point Arena, and the Stanley Electric Light & Power Company intends putting up a plant at once. The current is to be used to furnish Point Arena, Greenwood, Albion and Mendocino with light.

SANTA CRUZ, CAL.—The San Francisco Gas & Electric Company (S. L. Naphtaly, Superintendent), is reported to be surveying for a new power line from the Santa Clara Valley across the mountains to the plant of the Santa Cruz Portland Cement Company. The length of the line in Santa Cruz County will be 18 miles.

SAN FRANCISCO, CAL.—The administration announces that it has formulated a plan for a municipal street railroad system so attractive that private capital will readily take hold of it and construct the road under conditions that will permit the city to assume ownership after a stated period. The details of this plan for interesting capital are not made public.

SACRAMENTO, CAL.—The Central California Traction Company plans in the near future to install in Sacramento a complete system of street car lines that will reach every portion of the community. Franchises have been applied for. At a recent meeting of the directors in San Francisco it was decided to issue $1,500,000 of bonds for improvements and extensions.

SAN BERNARDINO, CAL.—At the recent annual meeting of the San Bernardino Valley Traction Company, A. C. Denman secured control of the property. The directors elected in his interest were A. C. Denman, Jr., George M. Coolley, E. D. Roberts, W. L. Brookeris and J. S. Wood. The following directors were chosen by the Fisher interests: Henry Fisher, E. S. Graham and O. Collins.

OAKLAND, CAL.—It is officially announced that the Martinez & Contra Costa Railroad Company, which has filed articles of incorporation at San Francisco, is to take over the franchise granted last February by the Trustees of Martinez to M. R. Jones, a local attorney, and is to begin the construction of an electric railway in that town. The new company was incorporated for $10,000. The directors are Purcell Rowe, W. A. Tolchard and Carl A. Johnson, of San Francisco; A. H. Flynn, of this city, and M. R. Jones, of Martinez.

SAN FRANCISCO, CAL.—It is reported that a new electric lighting and power company is about to enter the local field, and that contracts are being made for electrical machinery—motors, generators, dynamos, transformers, water wheels and copper wire for transmission. It is said that the company is backed by some of San Francisco's wealthy men, who have been quietly acquiring property in the mountains and doing the necessary construction work to impound water and develop power which can be converted into electricity. The company will begin operations, it is said, in the Chinese district of the city, and will light the Fairmont Hotel. It is also stated that the owners of the hotel, Herbert E. and Dr. Hartland Law, are interested in the new company.

FRESNO, CAL.—The San Joaquin Power Company has just completed its No. 3 plant between Crane Valley and the power house, and two more plants are to be started as soon as possible. The next plant will be built on the North Fork of the San Joaquin and will be known as No. 4. The other plant will be built on the Tule River, at the junction of the Middle and East Forks. Other improvements are also immediately contemplated, it is said. The present reservoir at Crane Valley will be raised ten feet so as to impound a larger quantity of the flood water. No. 1 ditch will be increased in size so as to carry 100 second-feet, corresponding in capacity with the ditch of the new power plant. This additional power is being developed to pump water for irrigation and to light every town in the valley.

HARTFORD, CONN.—After a report made by City Engineer Frederick L. Ford, the Board of Street Commissioners passed an order requiring all overhead electric wires within a half-mile of city hall to be taken down by October 1.

MERIDEN, CONN.—The Meriden Firearms Company, of this city, which is having plans drawn for the erection of another factory, will also install during the summer a large power plant. The boiler equipment will consist of two 500-hp boilers. The power developed will be used to operate electrical equipment in the factory and shops.

WATERBURY, CONN.—At the recent board meeting the Warden stated that last year no formal contract was entered into for the lighting of the streets, but that an agreement was made with the Torrington Electric Light Company. It was voted to renew this agreement by which the Torrington Electric Light Company is to furnish incandescent lamps of 25 cp for $25 each for the year, running an all-moonlight schedule.

WILMINGTON, DEL.—The Delaware & Atlantic Telephone & Telegraph Company is arranging to extend its conduit system.

WASHINGTON, D. C.—Bids will be received at the U. S. Engineer office, Washington Barracks, D. C., until May 1, for furnishing and installing an electric elevator, lighting fixture and Terrazzo floors. John Stephen Sewell, Corps Engineers, U. S. A.

WASHINGTON, D. C.—Bids will be received until April 17 at the Bureau Supplies and Accounts, Navy Department, to furnish at the navy yard, Washington, D. C., a quantity of naval supplies, including corundum wheels, electric supplies and white pine. Applications for proposals should refer to schedule 444. H. T. B. Harris, Paymaster General, U. S. N.

WASHINGTON, D. C.—Bids will be received until April 20 by the Commissioners of the District of Columbia (Henry B. F. MacFarland, Commissioner), for furnishing supplies for the use of the various branches of the government of the District of Columbia, for the fiscal year beginning July 1, 1906, and ending June 30, 1907, including electrical and plumbers' supplies.

MULBERRY, FLA.—The Prairie Pebble Phosphate Company, of Mulberry, Fla., has recently purchased seven 300-kw engine-type Bullock generators, seven 16-kw belted exciters and seven 75-hp induction motors.

ST. AUGUSTINE, FLA.—The new electric light service for St. Augustine has been inaugurated. The St. Johns Light & Power Company has completed the installation of the street lamps, and the service is giving entire satisfaction.

CHIPLEY, GA.—T. T. Murrah, of Chipley, writes that the company has not yet been fully organized to construct a water works and an electric light plant.

COLUMBUS, GA.—The Columbus Power Company recently completed arrangements for the issue of $4,000,000 of bonds. These will not, however, all be issued at once. Bonds aggregating $1,250,000 will be issued immediately and the proceeds used to provide for carrying out the company's plans for development and improvements.

ALBANY, GA.—The new power house of the Albany Power & Manufacturing Company, on the Muckafoonee Creek, just north of the city, has been completed. There are two generators, each with a capacity of 800 hp, and the plant has been so planned as to allow for the installation of two additional machines as the demands upon the plant may make them necessary.

POTLATCH, IDA.—C. Ferris White, architect, of Spokane, Wash., writes that the Potlatch Lumber Company is to construct a water works, and a heating plant, and an electric light plant at Potlatch to cost about $100,000. A. W. Laird, of Palouse, Wash., is manager.

SHOSHONE, IDA.—The Shoshone Falls Power Company, Limited, has finished its tunnel at Shoshone Falls, which has a fall of 241 ft. It is now concreting the tunnel. The company has floated a bond issue of $3,500,000. The plant will have 30,000 horse-power. One unit of 1,000 hp will be ready to utilize by May 15, and will be used in furnishing power to Twin Falls, Ida. One big generator, 6,000 hp, has already been ordered. There will be five at the plant in all. The company is now working on its canal at Auger Falls. This tunnel will be a mile and a half long, and there will be a fall of 147 ft. The company now has surveyors in the field surveying its transmission line to Salt Lake. This work started about three weeks ago, and will be completed within another month. Power will be furnished to Salt Lake within thirteen or fourteen months. The plants will have reserve power of about 6,000 hp each at Upper Salmon Falls, at Lower Salmon Falls and at the Malad River. The wires between Idaho and Salt Lake City will carry 100,000 volts. The insulators will weigh 65 lb. each and will be 20 in. in diameter.

MOUNT VERNON, ILL.—The Tri-County Telephone Company has increased its capital stock from $25,000 to $50,000.

CANTON, ILL.—The Central Union Telephone Company is planning to expend $15,000 in improving its local service.

FRUITVILLE, ILL.—H. G. Hogendobler and associates have incorporated the Fruitville Telephone Company, having a capital of $2500.

CHICAGO, ILL.—Reports state that the Illinois Manufacturers' Association is promoting a new telephone company, which promises a reduction of telephone charges to $60 per year and also proposes municipal ownership of the system after a certain number of years.

ROCKFORD, ILL.—Extensions of the Illinois Mutual Telephone Company, recently incorporated with headquarters at Seward, are planned for this season, which will connect the Home Telephone Company in this city directly with nine other towns in northern Illinois.

BLOOMINGTON, ILL.—The Kinloch-Bloomington Telephone Company is planning to install an entirely new equipment in its central exchange office. The company is also installing an $8000 switchboard in its office at Normal, and its overhead work, which was left uncompleted during the winter, will be finished during the next two or three months.

RICHMOND, IND.—City Engineer Fred Charles is preparing plans and estimates for the construction of a conduit system for all low-tension wires.

PETERSBURG, IND.—The Pike County Telephone Company has increased its capital stock to $40,000. A new switchboard and extensions will be put in.

HUNTINGBURG, IND.—The Dubois County Telephone Company has increased its capital stock to secure means to make improvements and install new apparatus.

INDIANAPOLIS, IND.—It is reported that the Laycock Power House Company contemplates the expenditure of about $80,000 in improving and enlarging its plant.

PERU, IND.—It is stated that Jerome Herff, Joseph Andrews and others, all of Peru, will this summer construct a power plant at the Shoals, to develop about 4000 hp.

EAST ENTERPRISE, IND.—The Farmers' Mutual Telephone Company, of East Enterprise, has been incorporated. Harvey Sedam, Wilson Oaks and Henry Kuhlman are the incorporators.

MARION, IND.—This city is to be made the starting point for a new electric railway to Chicago via Logansport. Steps have already been taken to get a line constructed between this city and Logansport.

GREENFIELD, IND.—The Peaceable Telephone Company of Jackson Township, Hancock County, has filed articles of incorporation. Fred E. Williams, A. E. Beaver, W. F. Kirkpatrie and others are directors.

RICHMOND, IND.—The Mayor is reported to have stated that he can sell the municipal electric light and power plant at any time for $250,000. Opinions vary as to the advisability of selling the plant and the Council is considering the question.

TERRE HAUTE, IND.—It is understood that the Stone & Webster syndicate contemplates expending $750,000 in improvements to its system during the summer. These include the construction of a line from Shelburn to Sullivan.

VINCENNES, IND.—The Vincennes Traction & Light Company has filed articles of incorporation. The capital stock is $200,000. Benjamin G. Hudnut and Charles A. Gordon, of Terre Haute; George E. Henry, Vincennes, and William Foley, of St. Louis, are the incorporators.

TERRE HAUTE, IND.—It is understood that the citizens have voted in favor of establishing a municipal electric light plant, and that for this reason the city council refused to consider the bid of the Traction Company for a 5-year contract for lighting the streets and has asked for a one-year bid.

MICHIGAN CITY, IND.—A. E. Smith, of Kenosha, Wis., representing a syndicate of gas and electric plants and electric lines operating in Wisconsin, is negotiating for the purchase of the Michigan City Electric railway lines. It is thought Mr. Smith's interest is identical with the Chicago Air Line Company now building from South Bend to Chicago.

RICHMOND, IND.—The Richmond Light, Heat & Power Company will increase the capacity of its power plant to a considerable extent. Some of the machinery which has been in use for several years will be replaced by new and more modern apparatus. The intention is to improve the service by constructing additional lines in order to compete with the municipal plant.

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company will install a 1000-kw Allis-Chalmers turbine generator in its new power house in this city. The new unit will generate two-phase current at 2300 volts, 60 cycles. It is also proposed to install a 30-kw, direct-connected engine-type exciter set, a 35-kw motor generator set, switchboards and condenser. The power generated by the new unit will be utilized for lighting and power purposes along the company's line and extension to be built to Burlington.

MUSKOGEE, I. T.—W. L. Reeves, A. W. Robb and others, of Muskogee, have secured a franchise for an electric light plant.

SHENANDOAH, IA.—J. W. Wynick has purchased the City Telephone System from Bell Brothers.

CEDAR FALLS, IA.—The electric light and gas plant at this city has been destroyed by fire, with a loss of $50,000.

MEDIAPOLIS, IA.—The Mediapolis Mutual Telephone Company has decided to increase its capital stock from $10,000 to $20,000.

DECORAH, IA.—Engineers Roberts & Abbott Company, of Cleveland, Ohio, are preparing plans for the proposed power plant for the Decorah Electric Light Company, to cost about $70,000.

RIPLEY, KAN.—The Cimarron Valley Telephone Company has been incorporated with a capital of $5000 by W. E. Baker and others.

CALDWELL, KAN.—It is reported that the city will install a $15,000 lighting plant this spring. E. E. Rogers, of Wamego, Kan., is engineer.

WICHITA, KAN.—Henry C. Scott, of St. Louis, president and treasurer of the Wichita Electric Light & Power Company, is making arrangements for the erection of a new building on Wichita Street east of the present power house in Waco Avenue.

GARDEN CITY, KAN.—Bids will be received at the office of the U. S. Reclamation Service, 876 Federal Building, Chicago, Ill., until May 28, for furnishing and installing complete, ready for operation, an electric power plant of 450-kw, switchboard, etc., for pumping purposes, including boilers, engines, generators, switchboards, etc.

GRAYSON, KY.—Maggard & Woods write that the proposed electric light plant will cost $5,000.

KUTTAWA, KY.—The Kuttawa Water & Light Company has decided to construct an electric light plant.

MONTICELLO, KY.—An electric light plant is being installed here and will be equipped with direct-current apparatus.

SPRINGFIELD, KY.—The Springfield Water & Electric Light Company is installing new machinery in its plant in order to provide for the supply of new lines which it will build at once.

SOMERSET, KY.—The Somerset Water, Light & Traction Company has commenced grading for its street railway, and will also reconstruct its wiring system for furnishing electric light and power.

PRESQUE ISLE, ME.—The New Brunswick Electric Power Company is arranging to let the contract for the construction of the pole line from the Aroostook Falls to Houlton.

LEWISTON, ME.—In correction of an item which appeared recently in these columns to the effect that it had been voted at a town meeting to make a 5-year contract for lighting Lewiston, we are in receipt of the following from a correspondent in that city. The city owns the plant from which the arc lamps are operated and it is run by water power from the pumping station at a cost per arc lamp not to exceed $35 per year. The electric light company supplies Auburn, which is just across the river from Lewiston, with lights at $55 per arc lamp a year. As the city plant is being operated in a satisfactory manner, no immediate change is contemplated.

HYATTSVILLE, MD.—The citizens have voted in favor of issuing $12,000 bonds for a municipal electric light plant.

ANNAPOLIS, MD.—A bill has been introduced to repeal and re-enact the charter of the Patapsco Electric and Manufacturing Company. The incorporators are George W. Harris and Thomas Van Loan, of New York, and James Nowlin, of Maryland. The company is authorized to do a general electric business, manufacturing and selling electrical machinery and appliances and to operate electric-light plants in any part of Maryland.

TAUNTON, MASS.—The bill to establish a municipal light board in Taunton was rejected.

RANDOLPH, MASS.—It was recommended at the town meeting that the sum of $3,300 be raised and appropriated for lighting the streets by electricity.

BROCKTON, MASS.—An order has been introduced in the Common Council for municipal ownership of the gas and electric lighting plants in the city.

LAWRENCE, MASS.—The Washington mills are to erect a new power house, the plans for which are being drawn by Dean and Main, the mill engineers of Boston.

NORTH ATTLEBORO, MASS.—The town voted at the annual meeting recently to appropriate the sum of $35,000 for the enlargement of the municipal lighting plant.

ACTON, MASS.—A petition has been submitted to the Legislature to authorize the American Woolen Company of New Jersey to furnish electric light and power in Acton.

NORTH ADAMS, MASS.—It is stated that the right recently obtained by the North Adams Gas & Electric Light Company from the legislature to use power from the Deerfield River is to be employed in the manufacture of Portland cement.

TEMPLETON, MASS.—C. C. Spears, town clerk, of Templeton, post office Baldwinsville, writes that an election will be held in May to vote on issuing bonds for an electric light plant.

MANCHAUG, MASS.—At the financial town meeting held recently it was voted to light the streets of Manchaug by electricity, and this will be done as soon as arrangements can be made with the Electric Light Company.

FALL RIVER, MASS.—Ground has been broken for the foundation of the new electric power house which is to be built for the Fall River Electric Light Company at the foot of Hathaway Street. The contracting engineers are Hubbard & French, of Boston.

WINDSOR, MASS.—The Windsor print works, which were formerly lighted by gas and electricity, will hereafter be lighted with electric lamps throughout, and the changes are now being made. The company is installing dynamos and will generate its own power.

NEWBURYPORT, MASS.—An effort is being made to have West Newbury unite with Georgetown and Groveland to build an electric plant for the purpose of furnishing light for the residences in the various towns. The power station will probably be located in Byfield.

GREENFIELD, MASS.—The high-tension power line between Gardner Falls and Hadley, upon which the Connecticut Valley Street Railway has been working for the past three months, has been tested and put in operation. It delivers electricity at 10,000 volts to the Hadley power house.

PEABODY, MASS.—The special committee on the electric lighting plant finds that it will cost about $50,000 to properly equip the plant with the needed new machinery. The committee is considering whether to call for this appropriation or to submit a plan to buy energy delivered at the power station.

WORCESTER, MASS.—According to press reports a plan has been advanced, which proposes to obtain sufficient power to run an electric lighting plant from the water now used for family and other purposes as it falls from the reservoirs here down to the city. The proposition is made by a representative of the Albany Automatic Ram Pump Company, who states that this plan is followed in several western cities, where the grade is less than that in Worcester.

NORTH ABINGTON, MASS.—The Stone & Webster Company, of Boston, has assumed control of the Electric Light & Power Company, of Abington and Rockland. The company will be continued under the name of the Electric Light & Power Company, of Abington and Rockland, for the present at least. The plant and system will be improved and enlarged, and the system may be extended to West Hanover. Superintendent Frank N. Sanderson will continue in charge.

HANOVER, MICH.—The Council is reported to have decided to install water works and an electric light plant.

MARSHALL, MICH.—At Ceresco, west of this place, two dams belonging to the Commonwealth Power Company were carried away.

PONTIAC, MICH.—Farnum Brothers, of this city, are promoting an electric railway to connect St. Charles, Alma, St. Louis and Ithaca and then run south to Owosso.

IRON RIVER, MICH.—At the recent village election in this place the proposition to bond the municipality for $20,000 for the purpose of installing an electric light plant was carried.

GRAND RAPIDS, MICH.—A. Walker, of Walkerville, and Dr. G. H. Hale and E. L. Brooks, of Hesperia, are said to be the promoters of an interurban railway between Walkerville and this city.

HART, MICH.—The Village Council is considering the question of issuing $20,000 bonds for buying local power to operate the lighting plant, or to lease the present plant to a syndicate which has plans for a power plant on Peremarquetto River.

ALPENA, MICH.—The Common Council has granted a franchise for the construction of an electric railway between this city and Long Lake, a distance of 8 miles. Dayton W. Closser and Jackson and Monroe capitalists are interested in the project.

LAPEER, MICH.—F. J. Schlegel plans to install machinery at once in his new electric light plant. He had orders placed for the apparatus three years ago, but was unable to get a franchise. Now everything is ready but the installing of the machinery.

BIG RAPIDS, MICH.—The Grand Rapids-Muskegon Water Power Electric Company will furnish power to light the streets of this city at the rate of $55 per lamp per year for ten years. The company is also required to furnish power for manufacturing purposes.

RICHLAND, MICH.—William V. Jacobs, of Chicago, has asked the village board and the Richland Township board for a franchise to construct an electric railway from Kalamazoo to Richland and touch the Grand Rapids-Battle Creek line now being constructed.

PONTIAC, MICH.—The Pontiac Standard Lighting Company will install a new generator, switchboard and lights. It is believed that eventually power generated from the Huron River will be delivered to this place. Glenn D. Smith, of Jackson, is the new manager of the company.

DETROIT, MICH.—Matthew Slush, of this city, who up to the recent sale of that property to the Detroit United Railway was president and general manager of the Detroit, Monroe & Toledo Short Line, is considering a proposition to build an important interurban line in Pennsylvania.

CONSTANTINE, MICH.—Bids will probably be called for in May for the development of the water power of St. Joseph River at Constantine. The probable cost of the work is placed at $120,000. H. L. Hartenstein is the owner. H. von Schon, 34 W. Congress St., Detroit, is the engineer.

DETROIT, MICH.—The Detroit, Flint River & Saginaw Valley Railroad is securing the right of way for an electric railway to connect Detroit and Saginaw. The company agrees to begin the proposed road on or before October 30, 1907. The work of grading in the townships is to be done under the supervision of the commissioner of highways.

GRAND RAPIDS, MICH.—H. R. Wager, representing the Commonwealth Power Company of Jackson, Mich., has asked the Board of Supervisors of Ionia County for the privilege of constructing a power dam on Grand River in Lyons township. The company already owns and operates three dams on the Kalamazoo River, generating about 20,000 hp and supplying five cities and two interurban lines. With the new dam in Lyons Township, the company can easily convey power into Ionia, Muir, Pewamo, Portland, Belding, and other villages in that vicinity. The Commonwealth Company was organized under the laws in Maine and is capitalized at $4,000,000.

LEWISTON, MINN.—Lewiston Telephone Exchange Company has increased its capital from $10,000 to $25,000.

ST. PAUL, MINN.—Mr. Stickney and Mr. Crosby have formed a new corporation for the erection of their power plant, which will cost about $75,000, and will be located east of the Stickney foundry on Custer Street.

SAUK RAPIDS, MINN.—The Watab Pulp & Paper Company, of Sauk Rapids, Minn., has purchased additional Allis-Chalmers electrical machinery, consistsing of an aggregate of 50 horse-power in small induction motors. The new mill, now nearing completion, is equipped completely with Allis-Chalmers apparatus.

ST. CLOUD, MINN.—Two dams instead of one are to be built across the Mississippi River south of St. Cloud, in order to develop the water power necessary for the proposed operations of the Mississippi River Power Company. One of the dams is to be built near Clearwater, the other at Monticello. Agents of the company have already bought flowage rights for both structures. It is estimated that the proposed works will involve an outlay of more than $1,000.000, but the company is said to have ample financial backing. Pulp mills are to be erected at Clearwater and Monticello, and electric power will be transmitted from the former place to St. Cloud.

LEXINGTON, MISS.—An election will probably soon be held to vote on issuing $22,500 bonds for an electric light plant. R. E. Wilburn is city clerk.

WATER VALLEY, MISS.—The city of Water Valley is a recent purchaser of Allis-Chalmers electrical machinery, consisting of a 135-kw belted generator and a 6-kw exciter for operation in conjunction with it.

HOUSTON, MISS.—The city of Houston, Miss., is a purchaser of new electrical apparatus from the Allis-Chalmers Company, Milwaukee. The new outfit consists of a 60-kw generator, a 3½-kw, direct-connected exciter, and nine transformers, built at the company's works at Cincinnati.

KANSAS CITY, MO.—The Jackson County Heat, Light & Power Company has been granted a franchise.

COLUMBIA, MO.—The citizens have voted to issue $30,000 bonds for extending the water works and electric light plant. John S. Bicknell is city clerk.

MACON, MO.—A move has been inaugurated at College Mound to build an interurban railway from Huntsville to Macon by way of that point. Captain C. J. DuBois is interested.

VERSAILLES, MO.—An election was held at Versailles, March 20, on the issue of city bonds in the amount of $5,000, to complete and extend the electric light system. The proposition was carried.

CHOUTEAU, MONT.—J. W. Jameson & Sons, of Stella, Neb., have decided to construct a flouring mill and electric light plant.

GRAND ISLAND, NEB.—The citizens have voted to issue $35,000 bonds for an electric light plant.

LINCOLN, NEB.—Bids will be received until April 11 by the Secretary of the Treasury (H. A. Taylor, assistant secretary), Washington, D. C., for furnishing and installing in the U. S. Court House and Post Office, at Lincoln, certain combination gas and electric lighting fixtures.

GRAND ISLAND, NEB.—Bids will be received by the city clerk at Grand Island, also by W. K. Palmer, consulting engineer, 718 Dwight Building, Kansas City, Mo., until April 23, for the equipment, material and supplies for the electric light plant and water works for Grand Island.

RENO, NEV.—All the officials of the Reno Electric Light & Power Company are being examined by the City Council in reference to a proposed ordinance of the city which will cut the present rate of the company in half. The company is financed by the Fleishhackers of San Francisco, who also operate the plant at Floriston, which supplies power to the Reno concern. The contention of the officials is that the Reno firm purchases power from Truckee, and as the latter is beyond the reach of municipal ordinances the rate to be imposed on Reno should not be made lower than it is, as the Truckee rate would produce a loss.

RAYMOND, N. H.—The contract for lighting the town by electric light has been renewed for the term of five years at a price not exceeding $1,000 per year.

TRENTON, N. J.—The bill which will empower the City of Camden to issue bonds for its own lighting plant has passed the House and is now in the Senate.

KEARNY, N. J.—The Public Service Corporation has secured the contract for lighting the town for five years at $85 per light per year, for arc lights, and $15 for incandescent lights.

RED BANK, N. J.—The Monmouth Traction Company, which operates between Red Bank and Long Branch, has applied for franchises from the Red Bank commissioners and from the Board of Freeholders. The plan of extension embraces a belt line in Red Bank.

JERSEY CITY, N. J.—There has been recorded in the Register's office a mortgage whereby the Whatcom County Railway & Light Company, a corporation of the State of New Jersey, pledges to the City Trust Company of Boston as trustee all its real and personal estate in the State of Washington, to secure an issue of bonds amounting to $2,500,000. Of this issue of bonds $1,400,000 are to be issued at once, $500,000 are to be retained for improvements, and the remaining $600,000 are reserved for permanent extensions and betterments.

PIKE, N. Y.—The citizens have voted to construct an electric light plant.

TROY, N. Y.—The Forest Park Railway Company has voted to increase the capital stock from $20,000 to $750,000.

WILLIAMSON, N. Y.—It is stated that the Sodus Gas & Electric Light Company, of Sodus, is to extend its system to Williamson.

DUNKIRK, N. Y.—The Bell Telephone Company has begun arrangements toward placing its wires and cables underground in Dunkirk.

UTICA, N. Y.—The Utica Gas & Electric Company has applied to the commission for authority to increase its capital stock from $2,000,000 to $3,500,000.

LOCKPORT, N. Y.—It is reported that the Ontario Power Company has voted $2,500,000 for the immediate completion of the company's power plant on the Canadian side.

CATSKILL, N. Y.—The Catskill Electric Railway Company contemplates a 6-mile extension to Cairo this spring. W. T. Seaman is superintendent.

POUGHKEEPSIE, N. Y.—Bids will be received by T. E. McGarr, Secretary State Commission in Lunacy, Albany, until April 11, for fire alarm system at the Hudson River State Hospital, Poughkeepsie.

ALBANY, N. Y.—The Home Telephone Company has increased its long-distance service by a combination of the independent telephone companies in Otsego County and the territory surrounding Oneonta.

ALBANY, N. Y.—The State Gas & Electricity Commission has given its permission to the Niagara Falls Electric Transmission Company to increase its capital stock from $100,000 to $3,500,000. The company asked to increase it to $5,000,000.

BUFFALO, N. Y.—It is stated that a bill will probably be introduced in the Legislature to empower the city of Buffalo to bond itself for the construction of a municipal lighting plant in conformity with the vote of the people at the last election.

GASTONIA, N. C.—The Piedmont Telephone & Telegraph Company increased its capital from $30,000 to $200,000. W. T. Love is president.

HICKORY, N. C.—The Water Power & Electric Company, of Hickory, is reported incorporated, with a capital of $250,000, to construct dams and power plants, and for lighting through Catawba, Caldwell, Alexander, Lincoln and Cleveland Counties. Incorporators: M. B. Thornton, C. F. Blalock and others, all of Hickory.

SPRINGFIELD, OHIO.—The Washington Traction Company has increased its capital from $10,000 to $800,000.

YOUNGSTOWN, OHIO.—The Central Union Telephone Company is planning to erect a new exchange building in Youngstown.

LAKEWOOD, OHIO.—The city administration favors spending $25,000 for a new generator and engine for the municipal lighting plant.

PAULDING, OHIO.—At a recent special election the citizens voted almost unanimously in favor of issuing $10,000 bonds to purchase the local lighting plant.

COVINGTON, OHIO.—The Covington Home Telephone Company has increased its capital stock from $23,000 to $71,000 and proposes to make important improvements.

AKRON, OHIO.—The County Commissioners of Summit County are having plans prepared for a lighting and heating plant to be installed in the new county court house.

WELLSBURG, OHIO.—The Tri-State Traction Company has applied for a franchise to enable it to enter Wellsburg. The company operates between Steubenville and Wheeling.

BROOKVILLE, OHIO.—The village will hold an election April 21 to vote on the matter of floating $7,000 bonds for the purpose of building a municipal electric lighting plant.

CLEVELAND, OHIO.—The contract for the establishment of a light and power plant at the garbage reduction works was awarded by the Board of Public Works to C. A. Dielhann & Co.

ASHTABULA, OHIO.—The Ashtabula Council has received a proposal from financial agents to build a new $1,000,000 waterworks and electric lighting and power plant west of Ashtabula harbor.

CANTON, OHIO.—The Merchants Heat, Light & Power Company has started its lighting and heating systems. The company is pushing the Nernst lamp and has a number of contracts for these lamps.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Company is preparing plans for a new exchange building which will be erected at once, and it will make important improvements to its switchboard and system in general.

COLUMBUS, OHIO.—The municipal lighting plant is greatly overloaded, and it has been decided to throw 600 lights out of service until such time as new generating equipment can be installed. An ordinance to sell bonds to provide for additional machinery is now being considered by the council.

YOUNGSTOWN, OHIO.—Property owners of North Avenue and Belmont Park Cemetery have petitioned the Mahoning & Shenango Valley Railway Company to extend its North Avenue line to the cemetery, a distance of 2 miles. Mr. Randall Montgomery, general manager of the company, is considering the proposition.

STEUBENVILLE, OHIO.—The National Telephone Company has closed the options for the purchase of the Phoenix Telephone Company's exchange. The new company proposes to rebuild the lines and plant throughout. The acquisition of the plant by the National will give Steubenville greatly improved long-distance service.

LIMA, OHIO.—The City Council has appropriated $25,000 for the purpose of installing a new boiler, engine, pumps and electrical equipment in the water works station. The Lima Railways & Light Company offered to supply the necessary energy at 5 cents per kw-hour, but the city decided it could save money by installing its own machinery.

CLEVELAND, OHIO.—The Rockford, Beloit & Janesville Traction Company has been absorbed by the Rockford Interurban Company, and a new corporation known as the Rockford & Interurban Traction Company has taken over the combined properties. The lines consolidated are the Rockford, Beloit & Janesville, the Rockford Interurban and the Rockford & Freeport.

FREDERICKTOWN, OHIO.—Walter C. Ball, Mayor of this place and the chief promoter of the Galion Southern Railway, which will extend from Galion to Mt. Vernon by way of Fredericktown, states that the right of way has been secured and that Eastern capitalists have agreed to finance the proposition. It is thought that work on the line will probably begin this summer.

MARSEILLES, OHIO.—E. R. Hankey, of Detroit, Mich., and G. W. Meeker, of Columbus, president and secretary respectively of the Findlay, Forest & Marion Electric Railway Company, have arranged for a right of way through this district. The line will extend from Marion to Findlay by way of Marseilles and Forest, and it is thought that construction work will start this spring.

LANCASTER, OHIO.—Control of the Lancaster Telephone Company has passed from the Federal Telephone Company of Cleveland to Columbus interests headed by F. R. Beam and others who control the Columbus Citizens' Telephone Company of that place. The capital stock of the company has been increased from $100,000 to $150,000 and the new money will be used to pay off floating debt and in improving the property.

COLUMBUS, OHIO.—At a recent annual meeting, the Columbus, Delaware & Marion Railway Company appropriated $300,000 to provide for a number of improvements, some of which are under way. The improvements include the extension of the line to Bucyrus and the purchase of 31 miles of rails, another 2000-kw turbo-generator for the Stratford power station and the completion of the Richwood-Greencamp spur line 6 miles long.

CINCINNATI, OHIO.—Bids will be received at the office of the Board of Trustees Commissioner of Water Works (Aug. Herrmann, president), for furnishing and installing four motor-driven centrifugal pumps, two having a capacity of 1,000 and two a capacity of 2,500 U. S. gallons per minute, for the filter plant on the water works grounds near California; also two steam-driven electric generating units, each of 75 kw, capacity for the Western Pumping station. Cincinnati.

TOLEDO, OHIO.—The Toleo Gas, Electric & Heating Company, a merger recently formed by independent lighting and heating companies, has asked the city that it be permitted to bid on street lighting in competition with the Toledo Railways & Light Company. Under the present laws the city can have no competitive bidding on street lighting, and Representative Hillenkamp has introduced a measure in the legislature giving the city the right to ask for bids from more than one concern. At present this can not be done without the vote of the people.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company will spend $30,000 in improvements within the next three months.

PORTLAND, ORE.—The Mount Hood Electric Light & Power Company is reported to have secured a franchise to lay wires and conduits and dispose of light and power in Portland.

PRAIRIE CITY, ORE.—The Consolidated Electric Light Company is considering the extension of its system to Prairie City. If the extension is constructed new machinery will be installed.

ROSEBURG, ORE.—J. Lindsay has filed notice of appropriation of 120,000 cubic inches of water right and a reservoir site on the Umpqua River. The water is to be diverted from the north bank of the river by a dam 30 feet high. The capacity of the proposed hydro-electric plant will be 10,874 hp.

SALEM, ORE.—The street railway lines of the Citizens' Light & Traction Company are said to have been sold to the Willamette Valley

Traction Company, which has in contemplation the construction of an extensive system to extend from Salem into the adjoining country. The company by the purchase secures entrance to the city.

PORTLAND, ORE.—In addition to other extensions recently announced the Portland General Electric Company has adopted plans for an immense power plant at Oregon City, which will involve a total expenditure of $2,000,000. It is to be situated at the east end of the Willamette River Falls, opposite the present plant, known as station B. Work preparatory to beginning the construction of the building will be carried on during the low water this summer and a portion of the plant will be erected next year. Additional sections will be added from time to time as the business of the company demands them, the plan being a comprehensive one, aimed to furnish facilities for providing the city with power and light for many years.

TURTLE CREEK, PA.—The Rose Hill Electric Light Company will increase its capital from $50,000 to $100,000.

CHAMBERSBURG, PA.—The entire system of the Pennsylvania Bell Telephone Company in this city is to be rebuilt.

HAZLETON, PA.—The Consumers Electric & Power Company will install as soon as plans and specifications are prepared a complete system for incandescent and arc lighting, turbine or Corliss engine and a three-phase, 60-cycle distribution system.

ALTOONA, PA.—It is stated that officials of the Pennsylvania Railroad Company are interested in a project to build an electric railway connecting this city with Pittsburg. It is also proposed to build a power plant capable of furnishing power to all the towns between Wilmerding and Derry.

ALTOONA, PA.—Preliminary steps have been taken for the construction of two hydro-electric power plants in Bedford County this summer. One will be located on Yellow Creek, at Loy's Gap in Hopewell Township; the other on the Raystown branch 4 miles east of Everett. The operating company is to be known as the Bedford Water Power & Electric Company.

STEELTON, PA.—This borough is now lighted by power supplie from the York Haven power plant. More than 100 arc lights and nearly 8,000 incandescents were lighted with power received from this source. The power is brought across the Susquehanna River near Middletown on cables, and a pole line is used from Middletown to Steelton, at a potential of 24,000 volts.

AVOCA, PA.—The Standard Electric Light, Heat & Power Company has under consideration plans for the enlargement of its plant, and the extension of lines to all the outlying territory, for the purpose of furnishing power and lighting to the mines and coal washeries in the vicinity. The connected load of this station is in excess of 10,000 16-cp equivalents, 135-hp motor load, 150 arc lamps, heating devices, etc. A contract was recently concluded with the Spring Brook Lumber Company to operate its entire mill by motor drive. The towns supplied from this station are Taylor, Moosic, Old Forge, Minooka, Hughestown, Smithville and Avoca. Mr. Frank Howard is superintendent and manager.

WILLIAMSPORT, PA.—The Eagles Mere Electric Light Company, in which a number of Williamsporters are interested, is preparing to enlarge its plant considerably and extend its service to both Picture Rocks and Hughesville. The capacity will be doubled—from 500 to 959 hp. The work has already been commenced, and it is expected to complete it in a month or more. The officers and directors of the company are as follows: C. LaRue Munson, Esq., president; John R. T. Ryan, William Emery, of Williamsport; H. L. Gyelin, H. S. Clay, of Philadelphia; H. S. Kirk, of Eagles Mere; Benjamin G. Welsh, of Sonestown, directors. Mr. Welsh is the general manager, and Raymond Carter of Williamsport, is secretary. The company was originally capitalized at $25,000.

McCONNELSBURG, PA.—It is reported that a project is now well under way for the establishment of an immense water power on the Raystown Branch of the Juniata River, near the well-known Juniata Crossings in Bedford County. At a point two miles west of the Crossings the ridge is about 500 feet high, and by a survey recently made it was ascertained that by a tunnel only 800 feet long through this ridge the river can be reached on the other side with a fall of about 35 feet. A dam five feet high will be constructed across the river, and it is proposed to divert the water from its natural channel and carry it through the tunnel. By the cut of 800 feet the course of the river will be shortened five miles. A company has been formed and has already obtained the right of way, and as soon as a charter is secured work will be commenced and pushed to completion, which must be within three years.

PROVIDENCE, R. I.—The Worcester & Providence Street Railway Company has been granted the right to increase its capital stock from $1,000,000 to $2,000,000.

PAWTUCKET, R. I.—At the next meeting of the Common Council the question of municipal lighting is likely to receive attention. At the last meeting Councilman Goldsmith presented a resolution appropriating $75,000 for this purpose. The money is to be expended under the direction of a committee of five elected from the floor. This resolution was referred to the committee on finance and that body has given it some consideration.

CLOVER, S. C.—The town is taking steps to light the city by electricity. Power will be obtained from the Catawba Power Company.

BAMBERG, S. C.—The Electric Supply Company, of Savannah, Ga., has secured the contract for constructing the municipal electric light plant for $15,000.

COLUMBIA, S. C.—Work is being started on the new $30,000 power house for the Columbia Railway, Light & Power Company. The new plant will furnish about 5,000 more hp.

CHARLESTON, S. C.—The Charleston & Summerville Electric Railway Company is asking for an extension of its franchise, which expires the first of June. The company claims that it will be prepared to start work shortly.

NASHVILLE, TENN.—The Nashville Railway & Light Company proposes, the County Court being willing, to extend the Woodland and Gallatin Pike line to Madison Station, a distance of seven miles from the city.

SHERMAN, TEX.—At a meeting of stockholders of the North Texas Telephone Company, it was decided to increase the capital stock of the company from $20,000 to $40,000.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company has filed an amendment to its articles of incorporation in the office of the Secretary of State, increasing its capital stock from $2,500,000 to $10,000,000.

GREEN RIVER, UTAH.—The Green River Land & Town Site Company proposes installing a power plant to raise water for irrigation purposes and electric power. E. T. Merritt, of Green River, is reported to be interested.

SANDY, UTAH.—The City Council has granted the Utah Light & Railway Company, R. S. Campbell, of Salt Lake City, manager, an electric light franchise in Sandy, under which the company will extend its line to Sandy and other towns.

SALT LAKE CITY, UTAH.—Specifications are on file at the office of THE ELECTRICAL WORLD, New York, N. Y., for installing in connection with the Strawberry Valley Reclamation project, a telephone system having four telephone stations and about 35 miles of pole line, bids for which will be received at the office of the U. S. Reclamation Service at Salt Lake City until May 2. Engineer, George L. Swendsen, of Salt Lake City.

FORT ETHAN ALLEN, VT.—The contract for operating the electric light system at the Post has been awarded to the Burlington Light & Power Company.

BELLOWS FALLS, VT.—The Fall Mountain Electric Light Company, which is controlled by William A. Russell of Lawrence, Mass., has recently bought the mill site at Gageville, a mile from here. It is understood that the company will at once build a dam and erect a power plant.

ALEXANDRIA, VA.—The Council has decided to call for bids for the city lighting franchise on a 30-year basis. A thoroughly modern plant is wanted.

NEWPORT, VA.—The Newport, Portsmouth & Newport News Electric Railway, it is said, may extend its lines from Portsmouth and Churchfield to Suffolk and Smithfield.

FRANKLIN, VA.—The Camp Manufacturing Company of Franklin, Va., is a recent purchaser of a 100-kw direct-current belted generator, a 12x36-in. Reynolds Reliance Corliss engine, and three 20-hp "Bullock" motors, from the Allis-Chalmers Company, Milwaukee.

WAITSBURG, WASH.—An electric railway is projected from Tukannon Creek. J. H. Morrow is interested.

ODESSA, WASH.—F. J. Holman and J. W. Smead, of Spokane, have petitioned the Council for a franchise for an electric light plant.

PORT TOWNSEND, WASH.—The Citizens Electric Company has been incorporated, with a capital of $30,000, by John Siebenbaum and others, to construct an electric light plant.

SEATTLE, WASH.—Fred E. Sanders has taken a contract to build two miles of electric road in connection with the system which he is constructing between Seattle and Everett.

WINONA, WASH.—Articles of incorporation have been filed for the Winona Telephone Company, of Winona, Whitman County, with a capital stock of $3000. The incorporators are: M. W. Fockler and F. J. Swane.

ABERDEEN, WASH.—The Grays Harbor Lighting Company has been organized under the name of the Grays Harbor Railroad & Lighting Company, with a capital of $500,000. Incorporators, George F. Stone and others.

NORTH YAKIMA, WASH.—George Weivle, of North Yakima, and Robert B. Hunter, of Seattle, are interested in the construction of a power plant on Yakima River at Union Gap for power and electric railway purposes.

TACOMA, WASH.—General Manager W. S. Dimmock, of the Tacoma Railway & Power Company has announced that the company will build a line to American Lake and the Tacoma Country Club this summer, construction work commencing as soon as the final surveys, now well under way, have been completed.

SHEBOYGAN, WIS.—The Sheboygan Light, Power & Railway Company is planning to spend large sums in improvements during the year.

MILWAUKEE, WIS.—The Milwaukee-Northern Railroad Company's franchise for its proposed Sheboygan line has been passed and signed by the Mayor.

WATERTOWN, WIS.—The City Council has granted the Wisconsin Light, Heat & Traction Company a 60-year franchise for an electric interurban railway which will pass through from Milwaukee to Madison, also making this city a junction point for two long trolley lines.

LA CROSSE, WIS.—The consolidation of the La Crosse Gas & Electric Company, the La Crosse Street Railway Company and the La Crosse Hydro-Electric Light & Power Company, under the style of the last-named concern, was recently announced. The company is reported to have filed amended articles of incorporation, increasing its capital stock to $5,000,000 and naming as its new president Samuel Insull; E. G. Boynton, vice-president, and Orlando Holway, secretary. The La Crosse Hydro-Electric Light & Power Company was originally incorporated a few months ago with a capital of $1,000,000 for the purpose of transmitting electric energy from Mormon Riffles, near Black River Falls, to La Crosse, a distance of something over fifty miles.

GRAND ENCAMPMENT, WYO.—Fire destroyed the plant of the power house of the Penn-Wyoming Company. Loss $500,000.

CARNDUFF, CAN.—A telephone company will be formed here with a capital of $10,000. W. T. Lockhart is interested.

WINNIPEG, MAN.—The Winnipeg Electric Company announces a large extension which will be built this summer to neighboring villages and settlements including the electrifying of the Winnipeg, Selkirk & Lake Winnipeg Railway recently purchased by the company and now operated by steam.

ZAMORA, MICH., MEXICO.—In this city there are three electric companies, the Guanajuanto Power & Electric Company, Verduzoo y Alvarez, and J. Bustamente. The first company lights Guanajuanto City and its power is employed in the mines of the same city; the second lights this city and has grain mills; the last is the smallest and has in this city only 500 incandescent lamps.

MEXICO CITY, MEXICO.—It is rumored that a company, organized in England, has purchased the Portezuelo waterfalls, in the state of Mexico, for the purpose of installing an electric power plant and transmitting the energy into Mexico City. These falls can develop at least 10,000 hp. The new company is to be known as the Compañia Electrica Anglo-Mexicana. The greater portion of the material for the plant and the equipment is to be brought from England, it is said, and the work is to be begun at an early date.

ST. JOHN, N. B.—The Safety Board on March 26, recommended that the offer of the St. John Street Railway Co. be accepted, to light the city for 10 years with 1,200 c.p. lamps at $70 per lamp per year.

CALGARY, N. W. TER.—H. E. Gillis, city clerk, writes that it is proposed to expend $150,000 in extending the electric light plant and water works and for new sewers.

CAMPBELLFORD, ONT.—A movement is on foot, if power can be sold to new manufacturers, to develop 4000 hp at Crow Bay, 3 miles from Campbellford. It is proposed to sell energy at from $10 to $20 per hp-year. The municipality will furnish free sites.

BRANDON, ONT.—The Brandon Electric Light Company is making large extensions to its plant in order to supply the increasing demands for power from manufacturers. The company will increase its lighting and power plant by 600 hp and has made arrangements for the building of another power house. It is expected that the new plant will be in operation about August 1.

Company Elections.

SAN FRANCISCO, CAL.—The annual meeting of the stockholders of United Railways of San Francisco was held March 15. The following directors of the company were re-elected: Patrick Calhoun, Charles Holbrook, George F. Chapman, B. S. Guinness, J. Henry Meyer, A. C. Kains, I. W. Hellman, Joseph S. Tobin, Thornwell Mullally, Tirey L. Ford and G. H. Davis.

MONMOUTH, IA.—The Keystone Telephone Company held its annual election of officers recently, resulting as follows: President, Dr. D. B. Stagg; secretary, L. B. Stuart; treasurer, B. R. Dye; directors, D. A. Bristol, Frank Ralston, Dr. Stagg.

ALMA, MICH.—At the annual meeting of the Union Telephone Company, held at Alma, the following officers were elected: President, Tod Kincaid, Owosso; vice-president, James T. Gibbs, Ithaca; secretary, John H. Fildew, St. Johns; treasurer, G. S. Ward, Alma; general manager, W. A. Melchers, Alma.

GRAND RAPIDS, MICH.—The annual meeting of the Vincennes Light & Power Company, of Vincennes, Ind., was held in this city recently and the following board of directors was elected: Edward M. Deane, Dwight Smith, Benjamin P. Merrick and Harry B. Wales, of Grand Rapids; Henry W. Frund, J. W. Emison, J. L. Bayard, Jr., R. E. Purcell, W. H. Vollmer and Charles Bierhaus, of Vincennes.

NEWARK, N. J.—Six of the subsidiary concerns of the Public Service Corporation held their annual elections recently in the offices of the Public Service on the ninth floor of the Prudential Building. The companies were: The United Electric Company, Orange; Passaic Valley Railway Company, Jersey City; Harrison & Kearny Railway Company, North Hudson Turnpike Company, and Bristol Electric Light Company. The directors in each instance re-elected Thomas N. McCarter, president; A. B. Carlton, vice-president; Frederick T. Evans, secretary, and James P. Dusenberry, treasurer. The United Electric Company, in addition to the foregoing, elected Charles A. Sterling, of East Orange, as second vice-president.

ALLIANCE, OHIO.—At a meeting held recently in Alliance the promoters of the Sandy Valley Traction Company organized as follows: William Pennock, president; W. W. Shidler, vice-president; E. F. Deford, treasurer; D. L. McIllravy, secretary. T. F. Hynes, of Cleveland, will have charge of the construction of the road which will extend from Alliance to Canal Dover.

COLUMBUS, OHIO.—The Columbus, Delaware & Marion Railway Company held its annual meeting recently. This is the holding and operating company of the Columbus, Delaware & Marion Electric Railway Company, the Columbus Northern Railway Power & Equipment Company, the Delaware Street Railway Company, the Marion Railway, Light & Power Company, and the Columbus, Marion & Bucyrus Railway Company. The following officers were re-elected: John G. Webb, Springfield, president; O. B. Gottschall, Dayton, vice-president; N. J. Catron, Columbus, secretary, and W. A. Black, Dayton, treasurer.

EASTON, PA.—The annual meeting of the stockholders of the Easton Gas & Electric Company was held a few days ago at the office of the attorneys, Smith and Brady, No. 4 Union Square, Phillipsburg. The following directors were elected: Uzal H. McCarter, F. W. Edgar, S. L. Shober, Jr., H. E. Mitchell, J. Madison Porter, Fred. R. Drake, H. A. Doan, T. W. Cramp, B. F. Cresson, S. C. Smith, E. J. Fox, Chester Snyder, A. D. Chidsey, W. J. Daub and F. S. Bixler. The directors organized by electing the following officers: President, Chester Snyder; first vice-president, Fred R. Drake; second vice-president, S. L. Shober, Jr.; secretary and treasurer, B. F. Cresson.

New Industrial Companies.

THE WACO ELECTRICAL SUPPLY COMPANY, Waco, Tex., has filed articles of incorporation, with a capital stock of $10,000. M. F. Wortham is among the incorporators.

THE ELECTRICAL PRODUCTS COMPANY has been formed at Ravenna, Ohio, to manufacture electrical appliances and supplies. It will begin the erection of a new plant in that place immediately.

THE A. RIEMANN ELECTRIC COMPANY, St. Louis, Mo., has filed application for articles of corporation, with a capital stock of $5,000. The incorporators are Anton Wind, George Riemann and Adam Riemann.

SYMPHONIC PHONE & NEEDLE COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital of $500, and the following directors: J. A. Monahan, A. C. Whitehead and J. W. Conway.

THE PATERSON LIGHT & EQUIPMENT COMPANY, of Paterson, N. J., has been incorporated by Mahlon Johnson, William N. Berdan and Donald Holmes. The company will deal in electric lighting equipment.

THE INTERNATIONAL CLARK WIRELESS TELEGRAPH COMPANY, Detroit, Mich., will capitalize with $2,000,000 for the purpose of covering the Great Lakes region with the Clark system of wireless telegraphy.

THE VIRGINIA ELECTROLYTIC COMPANY, New York, N. Y., has been incorporatd, with a capital stock of $100,000 by G. F. Seward, G. O. Seward and J. C. Walker. The company will establish a laboratory for the refining of metals.

THE JOPLIN ELECTRIC SUPPLY & CONSTRUCTION COMPANY, of Joplin, Mo., has been granted corporation papers. The capital stock is $5,000, all paid. The incorporators are W. L. Butts, A. S. Fowler and A. F. Hadden.

THE BECK FLAMING LAMP COMPANY, of Canton, N. Y., has been incorporated with a capital of $300,000. The company will manufacture electrical machines. The directors are C. J. Klebere, L. J. Auerbacher and S. S. Newton, New York.

THE C. E. COOK ELECTRIC COMPANY has been organized at 530 South Spring Street, Los Angeles, Cal., with a capital stock of $25,000 to do all kinds of electrical construction business. Mr. C. E. Cook is president; A. St. C. Perry, vice-president; W. J. Shugart, secretary.

THE CONSOLIDATED ELECTRIC COMPANY, of Norfolk, Va., has just been granted a charter by the Virginia Corporation Commission, and the new firm will shortly establish a permanent place of business in Norfolk. The company is capitalized at $15,000, and the officers are as follows: H. Root Palmer, president; W. G. Duncan, vice-president; J. P. Keeney, second vice-president; J. M. Williams, secretary and treasurer, and C. W. Breedlove, general manager, all of whom are connected with the Norfolk Railway & Light Company. The company will establish a general supply business for railway lighting and power plants and telephone systems.

New Incorporations.

FORT SMITH, ARK.—A company has been organized with $250,000 capital stock to take over and operate the Pan Telephone Company's system.

WALDRON, ARK.—The Citizens' Telephone Company, with a capital of $5,000, has been incorporated by W. A. Streator, W. L. Compere, H. C. Stanton and W. H. Plummer.

FLORA, ILL.—The Flora Telephone Company has been incorporated by F. C. Myers and others.

APPLETON, ILL.—Persifer Telephone Company, capital $1,200, has been incorporated by F. Reamer and others.

SEWARD, ILL.—The Illinois Mutual Telephone Company has been incorporated by Charles S. Thomas and others. The company has a capital of $2500.

FLAT BRANCH, ILL.—The Flat Branch Mutual Telephone Company, with a capital of $2000, has been incorporated. Among those interested is Thomas McKittrick.

BELLEVILLE, ILL.—Articles of incorporation for the Madison County Light & Power Company have been filed. The company is capitalized at $100,000 and the incorporators are Charles Zulley, George M. Mattis and B. E. Bramble.

ELGIN, ILL.—The Elgin & Bloomingdale Electric Railway Company has organized as follows: F. W. Kobusch, Bloomingdale, president; E. W. Fischer, Addison, vice-president; J. H. Koehler, Bloomingdale, secretary; C. F. Strauschild, Addison, treasurer.

VINCENNES, IND.—The Vincennes Traction & Light Company has filed articles of incorporation with the Secretary of State. The capital stock is placed at $200,000. Benjamin G| Hudnut, Charles A. Gordon, George E. Henry, William Foley and Morris Hudnut are the incorporators.

RINGSTEAD, IA.—The Farmers' Mutual Telephone Company has been organized at this city with Andrew Marsen, president.

ELDORA, IA.—Articles of incorporation have been filed for the Franklin-Hardin Telephone Company, with a capital stock of $3,500.

ACKLEY, IA.—The telephone exchange heretofore operated by Bruening & Symington has been sold to a stock company in which the citizens of this place, Iowa Falls, Des Moines, Waterloo and other places are interested. The new company is incorporated for $10,000. E. B. Smith, of Waterloo, is president of the new company; G. E. McFarland, of Des Moines, vice-president; F. J. Martin, of Ackley, secretary, and H. A. Miller, of the same place, treasurer.

CHANUTE, KAN.—The Kansas Railway, Light & Power Company has been incorporated, with a capital of $4,000,000 by L. Rosenthal, J. J. Jones, Frank Dixon and R. C. Rawlings, of Chanute, and J. W. Stephens, of New Orleans. The company plans to construct an extensive system of interurban lines in southeastern Kansas.

NEW IBERIA, LA.—The charter for the Bayou Teche Traction & Power Company, with a capital of $1,500,000, has been filed in the office of the District Clerk. The company is to build a system of electric railways from New Iberia to Berwick.

GARDINER, ME.—Articles of association have been filed with the railroad commissioners at Augusta for the Gardiner, Richmond & Topsham Street Railway. It is proposed to build an electric line from Gardiner through Richmond and Bowdoinham to Topsham, where it will meet the Lewiston, Brunswick & Bath road. The distance is 32 miles, the capital stock $180,000, and the directors as follows: Fred T. Bradstreet, Freeman Patten, Charles S. Whitney, Harry B. Lawrence and Fred S. Thorne, all of Gardiner; L. C. Ballard, of Farmingdale, and Noble Maxwell, of Richmond.

BELAIR, MD.—The Power & Light Company, of Harford County, has been incorporated with a capital of $50,000 by P. Leslie Hooper, Hollis Courtney, Jr., M. H. Fahey and others.

AUDUBON, MINN.—The Audubon Telephone Company has been incorporated with $15,000 capital.

MINNESOTA, MINN.—The Minnesota Telephone Company has been formed with $5,000 capital. F. C. Murray is secretary.

SANBORN, MINN.—The Sanborn Telephone Company, with a capital of $15,000, has been incorporated by Henry J. Fink, F. W. Slivers, George A. Dreblow, H. K. Schroeder, H. Schwerdtfeger, Sanborn; Emil Gerth, Germantown; Charles Goehring, Charlestown.

KANSAS CITY, MO.—The Lindsey Light Company of Illinois filed articles to show that it had been incorporated under the laws of that State, with a capital stock of $100,000, of which $2500 is to be used in Missouri, with an office in Kansas City.

ST. LOUIS, MO.—Articles of incorporation of the Orrville & Bellefontaine Mutual Telephone Company have been filed in Clayton, St. Louis County. The office of the company will be located at Gumbo. Its capitalization is placed at $4,000.

HELENA, MONT.—Articles of incorporation have been filed for the East Fork Telephone Company. The principal place of business is at Rogers. The directors for the first three months are: A. V. Rogers, J. D. Clark, S. F. Bowman, of Rogers, and J. W. Miller and Walter C. Dowling, of Lewiston. The capital stock of the company is $6000.

NEWARK, N. J.—The Atlantic City Light & Equipment Company has been incorporated, with a capital of $50,000, by Harry R. Harris, George B. Clemmer and James J. Farmer.

NEWARK, N. J.—The Great Falls Electric Properties, Newark, have been incorporated to construct and control street railways, amusement parks and water power in any part of the world. The concern has a capital of $1,000,000. Incorporators are Pressley H. Bisland, William S. Brayton and Robert Randall.

OCEAN CITY, N. J.—The Atlantic City & Ocean City Railroad Company has filed articles of incorporation in Trenton. The company intends to construct a road from Somers Point to a point in Ocean City, a distance of about 2 miles. The directors are: John A. MacPeak, F. R. Hansell and Joseph F. Cotter, of Philadelphia; George A. Duval, J. H. Switer, Charles Riceman and George H. B. Martin, of Camden.

HANNIBAL, N. Y.—Bethel Telephone Company has been incorporated with a capital of $2000 by L. D. Harman and others.

WORCESTER, N. Y.—The Worcester Light & Equipment Company has been incorporated with a capital of $100,000, by A. M. Thompson and others.

PENN YAN, N. Y.—Yates County Telephone & Telegraph Company has been incorporated with a capital of $5,000. Incorporators: Frank E. Spencer, Benton, N. Y.; Fred Culver and M. L. Spooner, Penn Yan,

JAMESTOWN, N. D.—The Jamestown Traction Company has been formed to build an electric railway to Courtenay.

RICHARDTON, N. D.—The Richardton Telephone Company has been incorporated with a capital of $10,000. Incorporators, Joseph Kilzer, Fred Koesel, D. P. Abby, Fred Pathman, R. J. Fleck, John H. Breum, Lewis Davis, Richardton, N. D.

COLLINS, OHIO.—The Townsend Home Telephone Company is being formed by C. B. Canfield, A. D. Bargus, George E. Stacey, C. L. Moore and others of this place.

ROGERSVILLE, OHIO.—The Rogersville Telephone Company has been formed with a $5000 capital stock by George Weiss, T. B. Gerber, William Miller, Charles Lieser, Daniel Doll and others.

OTWAY, OHIO.—The Farmers' Union Telephone Company has been formed with a capital stock of $1000 by J. E. Faul, H. R. Dugan, Edgar Dugan, E. J. Ogden, J. A. Laylin and others.

COLUMBUS, OHIO.—The Townsend Telephone Company, with a capital of $10,000, was incorporated by C. B. Canfield, C. L. Moore, George W. Helling, A. D. Bargus and George E. Stacey.

BIRMINGHAM, OHIO.—The Henrietta Telephone Company has been formed at Henrietta; $5000 worth of stock has been sold and telephones will be put in throughout a wide farming community.

HENRIETTA, OHIO.—The Henrietta Rural Telephone Company, of Lorain County, has been formed with $4000 capital stock by G. T. Unger, John M. Unger, W. C. Porter, George Delifield, J. Wiedman and others.

EAST LIVERPOOL, OHIO.—By the incorporation of the Steubenville & East Liverpool Railway & Light Company, at Columbus, Ohio, the last step has been taken to insure a continuous electric interurban railway service between Pittsburg and Wheeling, W. Va.

YOUNGSTOWN, OHIO.—It is stated that Youngstown people are soon to incorporate a new company, with a capital of $100,000, to be known as the West Side Belt Line Company, with a view to building a belt line from Central Square in Youngstown over a number of city streets to the villages of Mineral Ridge, Austinburg and Four Mile Run.

MILTON, ORE.—The Milton Rural Telephone Company, with a capital stock of $5000, has been incorporated by C. E. Simonds, William Forsythe and J. B. Saylor.

PORTLAND, ORE.—Articles of incorporation have been filed for the Multnomah & Clackamas County Mutual Telephone Company. The capital stock is $5000 and the incorporators are Napoleon Davis, Eugene S. Jenne and Timothy Brownhil.

REE HEIGHTS, S. D.—The Ree Hills Telephone Company has been incorporated with a capital of $2000 by B. S. Bell and others.

PIERRE, S. D.—Articles have been filed for another telephone company in the White Lake and Southern line, with a capital of $25,000 and headquarters at White Lake. The incorporators are William A. Bogenhagen, Henry Mossman and Herman Suelflorn.

MALLARD, TEX.—The Mallard Telephone Company has been incorporated with a capital of $8,600 by F. L. Snodgrass and others.

YANTIS, TEX.—Yantis Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of constructing a telephone system. Incorporators: B. L. Farr, C. E. Smith, L. C. Mapes, J. S. Flanagan and W. M. Camblin.

BLACKSBURG, VA.—The Blacksburg Power & Supply Company has been granted a charter to maintain a power plant for the generation of power by steam, gas or electricity. The company is capitalized at $50,000, and D. H. Keister is president.

WALLA WALLA, WASH.—The committee on incorporation for the Covello-Wallula Electric Railway is preparing papers of incorporation. The capital stock is to be $3,500,000 and when issued a majority of it is to be held among merchants of Walla Walla, Columbia, Garfield and Asotin counties.

SEATTLE, WASH.—Articles of incorporation have been filed of the Shore Line Electric Company, with a capital stock of $1,500,000. The object of the corporation is to construct an electric railway along the shore of Puget Sound from Seattle to Tacoma. The incorporators are Joseph Winship, Charles E. Adams, Fred J. Kerr, M. L. Hamilton, Conrad L. Hoska and C. E. Muckler.

BROWNTOWN, WIS.—The Browntown Telephone Company has filed articles of incorporation and applied for a charter in the office of the Secretary of State. The company is capitalized at $5500 and incorporated by O. M. Erickson and others.

Legal.

WATTMETER LITIGATION.—The United States Circuit Court for the Northern District of New York has filed a decree enjoining the defendant in the case of the General Electric Company vs. the Madison County Gas & Electric Company, from using alternating current integrating wattmeters or other motor devices embodying a provision for securing an approximate 90-phase adjustment by induced circuit. The infringement consisted in the use of Scheeffer wattmeters manufactured by the Diamond Meter Company of Peoria, Ill.

DESIGN PATENTS.—The Court of Appeals of the District of Columbia in the matter of the patent application of O. A. Mygatt, president of the Holophane Glass Company, has held that descriptive matter may be not only proper but necessary and allowable in design patents. A few years ago Congress passed a law apparently limiting design patents to a drawing without the rights of any further explanation, or specification, than the words: "A design as herewith shown." The present decision is held to be in consonance with the statutes relating to the grant of design patents. Reflectors are the subject matter.

Obituary.

MR. GEORGE FARNSWORTH, superintendent of tariffs for the Michigan State Telephone Company, Detroit, Mich., died at his home, 488 Cass Avenue, on March 23, of neuralgia of the heart and Bright's disease.

MR. AXEL H. ENGSTROM, of Philadelphia, Pa., consulting engineer in electric railway and power plant work, died in that city on March 21. Mr. Engstrom was born in Sweden and was 49 years old. He had lived in America for twenty-five years.

MR. EDWARD BACKUS, commissioner of electric lines and lights of Somerville, Mass., died on March 26 at his home, aged 58 years. When, under the provisions of the new city charter adopted in 1900, the office of commissioner of electric lines and lights was created, Mr. Backus received the appointment and served in that capacity until his death. He is survived by a son and daughter.

MR. A. O. BOSTROM.—Mr. August O. Bostrom, well known as a chemist, mathematician and electrician, for many years a mechanical expert in the Navy Department and the inventor of the improved turrets now in use in the United States Navy, died at his home in Washington, recently, aged 59 years. He was a native of Sweden, came to the United States at an early age, was graduated from the Rensselaer Polytechnic Institute in civil engineering, and entered the Navy Department in 1877.

MR. JOHN C. KAFER, whose organizaion of the engineering firm of Kafer, Mattice & Warren, we announced only last week, died suddenly at Dumont, N. J., on March 30, aged 64. He was in the U. S. Navy from 1863 to 1885, and as an instructor in the Naval Academy had as students many men since prominent in the electrical and mechanical fields. He was president of the Engineers' Club 1901-4, had been active in its affairs until his death, and was a member and treasurer of the conference committee for the administration of the Carnegie gift of $1,500,000 for the United Engineering Building and the Engineers' Club. The engineering profession has lost one of its ornaments in this high-minded, public-spirited man.

MR. GEORGE L. BRADLEY, of Washington, D. C., died on March 26, of pneumonia, at his residence 1503 Twenty-third Street. He was one of the founder of the Bell Telephone Company of America, now the American Telephone & Telegraph Company, and at one time owned a majority of its stock. At the time of his death he was a member of the board of directors of the company, and also a director in the Mergenthaler Linotype Company. Mr. Bradley's industrial enterprise was the construction of the canal in Florida connecting the St. John River to the Biscayne Bay. The work is nearly completed and will cost when finished $1,500,000. He was a member of the Metropolitan, Alibi and Chevy Chase Clubs. Both he and Mrs. Bradley, who survives him, were for many years prominent in Washington society. Mr. Bradley was a native of Newburyport, Mass., and 60 years old at the time of his death.

MR. G. MARTIN BRILL, president of the J. G. Brill Company, died suddenly on March 31 at his home in Merion, a suburb of Philadelphia. He was born in Hesse Cassel, Germany, in 1846, the eldest son of John George Brill, who came to this country in 1847, and settled in Philadelphia, where he was employed in the car building concern of Murphy & Allison. After his graduation from the public school, Mr. Brill obtained a position with that firm and was foreman of the woodworking department for several years. In 1868 the plant was destroyed by fire, and as the firm decided to discontinue street car building, Mr. Brill and his father took up this branch of the business. A small shop was rented, and the new firm of J. G. Brill & Son commenced in a very modest manner. The quality of workmanship of the productions was quickly recognized, and year after year it was necessary to purchase additional ground and erect buildings, until all the available land in the vicinity (four and a half acres in extent) was covered. In 1890 the present plant, comprising eighteen and a half acres, covered with modern buildings, was occupied. Since the death of his father in 1888 Mr. Brill has been the president of his company, and until recently was also its general manager. Finding it necessary to take care of an increasing volume of business, the Brill Company has purchased within the last few years the American Car Company of St. Louis, the G. C. Kuhlman Car Company of Cleveland, and the John Stephenson Company of Elizabeth, although each of these plants is operated separately. The Philadelphia plant has received important additions nearly each year of its history. Mr. Brill possessed a large frame and was large in mind and heart. In the business world he was regarded as an unusually able organizer and director of affairs. His business associates knew the man they were dealing with, for he spoke plainly and his methods were always governed by high principles. Nearly one hundred valuable patents issued to him on cars and trucks and parts of their equipment attest his wide knowledge of the requirements of modern railroading and his alertness toward improvement. Mr. Brill was a member of the Manufacturers' Club in Philadelphia, the New York Club, the Union Club of Cleveland, the St. Louis Club, director of the Merchants' National Bank of Philadelphia and a director of the Interstate Railway Company. He had a very wide acquaintance in the electrical field, and took a deep interest in the growth of the electric railway from the earliest days of Sprague and Van Depoele.

Educational.

OHIO STATE UNIVERSITY.—Professors Magruder, Anderegg and Caldwell of the mechanical and electrical engineering department, accompanied by eighty students of that department, are making an inspection tour through the East. They will visit power stations at Pittsburg, Cleveland, Buffalo, Niagara Falls and other points in New York State.

THE TRI-STATE COLLEGE OF ENGINEERING, of Angola, Ind., has filed articles of incorporation. The capital stock is $10,000. The purpose is to establish, maintain and conduct a school of engineering. A course will be given in civil, in mechanical or electrical engineering, or a combined course in mechanical and electrical engineering. Littleton N. Sniff, L. W. Fairfield and W. O. Bailey are the incorporators.

UNIVERSITY OF WISCONSIN.—During the past year the enlargement of the shops of the college of engineering has resulted in the extension and development of the electrical engineering laboratories of the University of Wisconsin until now its equipment includes over sixty dynamos, motors, meters and transformers for the use of the students, as well as 200-kw polyphase alternator and 100-kw direct-current generator, power for which is furnished by a new 300-hp Filer and Stowell Corliss engine, and 150-hp Ideal high-speed engine. The space afforded for this laboratory by the west and south wings of the machine shop allows of much flexibility of arrangement, and makes it possible to accommodate a large number of students. The dynamos and motors are of both continuous and alternating current types, ranging in size from a fraction of a horse-power to 270 hp. A large number of these are of a capacity ranging from 6 to 12 hp, and are therefore particularly adapted for laboratory instruction of the 178 students of electrical engineering.

Personal.

MR. J. A. HUNNEWELL, superintendent of the Whitman, Mass., electric light plant, has been appointed to take charge of the Lowell lighting plant.

MR. H. J. MEYER has resigned his position as superintendent of the electrical department of the Shreveport, La., Gas, Electric Light & Power Company, and Mr. A. T. Lloyd has been appointed as his successor.

MR. RAYMOND STEWART, an electrician of Bangor, Me., has been appointed superintendent of the Dexter Light & Power Company, Dexter, Me., which is owned by the United Illuminating Company, of Boston, Mass.

MR. JAMES F. LARDNER, manager of the Tri-City Railway Company has been appointed general manager of the Tri-City Railway & Light Company, which has recently secured control of the public utility companies of Moline and Rock Island, Ill., and Davenport, Ia.

MR. FREDERIC NICHOLLS, rear commodore of the Royal Canadian Yacht Club, has prepared in very handsome lithograph, broadsheet form, and distributed among his friends, Nelson's famous "duty" signal at Trafalgar. It has a portrait of the hero, and as supporters, the Nelson column in Trafalgar Square, London, and Turner's beautiful painting of the fighting Temeraire. It was a happy thought of a patriotic Anglo-Canadian to do this.

MR. G. A. REDMAN.—A feature of the social life of DeLand, Volusia County, Florida, is the meetings of the Tourist Club, whose members represent almost every State in the Union. As in other cities of Florida, a large percentage of the residents are those who come from Northern States to spend the winter in their Southern homes. The president of the Tourist Club is George A. Redman, formerly general manager of the Rochester Gas & Electric Company. This gentleman with his family has lately spent a good deal of time in travel.

MR. F. V. T. LEE, manager of the San Francisco office of the Stanley-G. I. Electric Manufacturing Company, has been appointed assistant manager of the Pacific Gas & Electric Company, taking effect April 1. In this position Mr. Lee will be the active assistant of John R. Britton, president and general manager of the company. The position of manager of the San Francisco Gas & Electric Company, which Allan Pollok has

recently resigned, is to be abolished, and the duties divided among other officials.

MR. GEORGE J. LOW started this week on an extensive foreign trip in the interests of the Atlas Engine Works, E. C. Atkins Co., Nordyke & Morman Co., the American Steam Pump Co., and the Ohio Valley Pulley Works. His itinerary includes Honolulu, Japan, China, Vladivostock, Manila, Australia, New Zealand, South Africa and the principal European centers. Mr. Low has been over the ground before in the interests of the Atlas Engine Works and has been eminently successful in building up their foreign business.

MR. GEORGE H. PATTEN has entered the service of the Chattanooga Electric Company, Chattanooga, Tenn., in the capacity of contract agent in charge of its "New Business-Getting and Advertising Department." Mr. Patten is an electrical engineer and has been connected with the General Electric Company for the past six years. He represented the General Electric Company at the St. Louis Exposition and at the Lewis and Clark Exposition, Portland, Ore. Mr. Patten will have on his staff Mr. Frank H. Hiner and Mr. Edgar H. Stegall.

MR. J. D. ZOOK has assumed the management of the machinery and repair department of the Northeastern Electric Equipment Company, of St. Paul, Minn. He was for eight years in the employ of the Gregory Electric Company, six as foreman of the armature department, one as general foreman and the last year as general superintendent. Previous to that time he was connected with the Northern Electric Company as foreman of the armature room, and prior to that, six years with the Rockford, Ill., Electric Company as foreman and superintendent. With seventeen years' experience in the management of the repair and machinery departments of large electrical concerns, Mr. Zook has mature qualifications for his present responsibilities.

MR. W. B. READ.—The executive officers and members of the engineering staff of the New York City Railway, together with a number of personal friends of Mr. W. Boardman Reed, who retires from the position of chief engineer of the company to go into business for himself, met in the ballroom of the Hotel Astor on March 31 to attend a dinner to Mr. Reed. President H. H. Vreeland of the New York City Railway Company, in his address, said of the guest of honor: "It is easy to take a well-oiled, smooth-running machine and operate, but it is quite another thing to create, build and carry to completion such a machine and hand it down to his successor. That is what Mr. Reed has done." Mr. Vreeland presented to Mr. Reed an engrossed set of resolutions and a four-hundred-dollar ring on behalf of those present. On behalf of the legal department of the company Mr. H. A. Robinson gave Mr. Reed a gold watch.

Trade Publications.

ELECTRIC CAR BRAKES.—The Westinghouse Air Brake Company, Wilmerding, Pa., has just issued in very neat pamphlet form the excellent paper on "Air Brakes for Electric Cars," read by Mr. W. S. Bartholomew last November before the New England Street Railway Association.

ELECTRICAL EQUIPMENT OF A SHIP YARD.—Bulletin No. 1039 of the Allis-Chalmers Company, Cincinnati, Ohio, contains a well illustrated description of electrical power distribution and application in the ship-building plant of the Fore River Ship and Engine Company, at Quincy, Mass.

DIRECT-CURRENT MACHINES.—The details of construction of a complete line of direct-current motors and generators ranging in size from 1 hp to 50 hp, are outlined in an illustrated bulletin designated as No. 367, which has recently been issued by the National Electric Company, Milwaukee, Wis.

TELPHERAGE, as represented in the work of the United Telpherage Company, is the subject of a brochure in French by Guarini, brought out by H. Dunod and E. Pinot, of Paris. It is an interesting summary of the work done in this country in developing this aerial system of transporting material electrically.

LOCAL BATTERY TELEPHONES.—Bulletin No. 101 of the Dean Electric Company, Elyria, Ohio, which is devoted to local battery or magneto type telephones, in addition to giving an adequate description of the telephones themselves, contains numerous diagrams of telephone circuits which should prove of much interest to telephone engineers.

CEMENT MACHINERY.—The Allis-Chalmers Company, Milwaukee, Wis., has issued as catalogue No. 129, a treatise on the manufacture of cement which gives descriptions of cement-making machinery including rock breakers, crushers, dryers, kilns, ball mills, tube mills, elevators and conveyors. The machines are designed for each stage in cement making by either the wet or the dry process.

INDUCTOR ALTERNATOR.—In Bulletin No. 147, the Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., gives an interesting discussion of the properties of the inductor alternator. This machine has absolutely no moving wire, collector rings or brushes. It is stated that it has high efficiency at partial as well as at full load, and that it can be built with any regulation desired.

GUY ANCHORS.—The 1906 catalogue of W. N. Matthews & Bro., 39 Cortlandt St., New York, is a neatly executed publication dealing with Stombaugh guy anchors and Kearney cable clamps. The catalogue contains a report of a test of the holding capacity of the anchor in both sandy and clay soils, and gives a formula for expressing the holding capacity in terms of the diameter of the helix and the depth to which it is buried.

HYDRAULIC TURBINES.—Bulletin No. 2 of the I. P. Morris Company, Philadelphia, Pa., is intended for the use of consulting hydraulic engineers and others desiring information concerning the variation in power and efficiency of a turbine wheel when run at a constant speed and operating under varying pressure heads. Numerous curves are shown of the calculations connected with a 13,500-hp turbine designed and built for the Shawinigan Water and Power Company.

"THE PRESERVATION OF SHIPS," a publication issued by the Long Arm System Co., of Cleveland, Ohio, represents a distinct departure in trade literature. The company manufactures electrically operated bulkhead doors and hatch-plates for ships, its system being in use on all the new vessels of the navy. Instead of the customary catalogue, it now puts out a series of "short talks" on the principles of safety at sea, and the conditions under which safety can best be procured, with special reference, of course, to the overwhelmingly important part of watertight bulkheads and their doors in producing the unsinkable ship.

DEPARTMENT STORE LIGHTING.—An artistic booklet devoted to electric lighting in the department store has just been received from the Nernst Lamp Company, Pittsburg, Pa. The keynote of the booklet is that "the store manager can no more afford to consider the question of lighting from the utility standpoint alone than he can afford to use shabby furniture and fixtures." Means are discussed for obtaining the proper quality, quantity and distribution of illumination so as to show up the merchandise to the best effect and, at the same time, to be attractive to the customer. It is stated that for the illumination of stores, the Nernst lamp gives twice the amount of light for the same power as does a carbon filament lamp, and that it is about 10 per cent. more efficient than the carbon arc lamp for interior illumination.

News of the Trade.

STANLEY-G. I. offices in New York City have been moved to 42 Broadway. The stock room is on Washington Street.

MANUFACTURERS' ADVERTISING BUREAU announces its removal on April 2 from 126 Liberty Street, New York City, to 237 Broadway.

THE SUMTER TELEPHONE MFG. COMPANY, Sumter, S. C., whose plant already covers 130,000 feet of floor space, is now erecting an additional wing in order to keep up with the demand for its product.

THE W. S. HILL ELECTRIC COMPANY, New Bedford, Mass., at its recent annual meeting elected the following board of directors: Charles S. Mendell, F. A. Soule, George R. Stetson, A. P. Smith, N. P. Soule, W. R. West and R. A. Soule.

THE CAWOOD MICA COMPANY, 367 Ellicott Street, Buffalo, N. Y., is operating mines at Shawville, Quebec, and Shelby, N. C., and is doing a constantly increasing business with manufacturers of electrical apparatus. The amber mica from the Canadian mine is particularly well adapted to commutator work on account of its soft, even quality.

BANNER ELECTRIC COMPANY, manufacturer of incandescent lamps, Youngstown, O., has opened a Southern office at 12-16 Trinity Avenue, Atlanta, Ga., where it will carry a complete assortment of lamps. The office will be under the management of Mr. G. E. Watts, formerly of St. Louis, who has moved his family to Atlanta and will take up permanent residence there. Mr. Watts is a pioneer in the lamp business, having been engaged in the sale of incandescents for many years. He has traveled through the Southern States included in his territory and has a large acquaintance.

A CLEAN ENGINE ROOM is difficult when dozens of individual oil cups and oil holes must be given periodical attention by "the man with the can." A dirty, oil-soaked engine room is an eyesore to the engineer, an element of danger by fire, and an evidence of waste and loss to the man who pays the bills. This state of affairs is obviated by use of the White Star continuous oiling system because the lubrication of bearings is done by a steady flow of pure oil from a reservoir replenished only at long intervals—direct from the barrel. Appreciation of the value of this method of lubrication is shown by the following concerns which are among the recent purchasers of White Star oiling systems: The Pittsburgh Gage & Supply Co., Pittsburg, Pa.; Roland Park Elec. & Water Co., Baltimore, Md.; Jones & Laughlin Steel Co., Pittsburg, Pa.; Pennsylvania Railway Power Station, Allegheny, Pa.; Link-Belt Machinery Co., Chicago; Bullock Electric Manufacturing Co., E. Norwood, O.; International Paper Co., Glens Falls, N. Y.; C. A. Cambrill Manufacturing Co., Ellicott City, Md., and Hazard Manufacturing Co., Wilkesbarre, Pa.

THE VAN DORN & ELLIOTT ELECTRIC COMPANY, of Cleveland, Ohio, has gone into the manufacture of electric drills for various purposes on quite an extensive scale. It will have a line of breast drills for ship-building, boiler shop and structural iron work, taking the place of pneumatic drills for these purposes, and it will also build a light portable drill for drilling bolt and bond holes in railway tracks. The outfit is small and compact, weighing less than 60 pounds, so that it can be handled and removed from the track by one man, and it has the advantage of automatic feed and regulation. The Van Dorn & Dutton Company, with which the above mentioned company is affiliated, is erecting a new factory building 60 x 150 ft. and two stories high. A portion of the new factory will be occupied by the Van Dorn & Elliott Company. All machinery will be electrically driven with shafting sectionalized and the company will buy a generator, switchboard and about six or seven motors. A 100-hp gas engine has been contracted for.

INTERNATIONAL ELECTRIC COMPANY.—Several men in Salt Lake City, Utah, have purchased control of the International Electric Company from S. F. Fenton, and are preparing to go into electrical engineering on a large scale in addition to the contracting and supply business. The organizer of the company, who will be its president, is Murray C. Godbe, now electrical engineer for the Utah Light & Railway Company. Other officers of the concern are as follows: Vice-president, Joseph J. Daynes, Jr.; secretary and manager, C. B. Hawley; treasurer, W. S. McCornick. Mr. Godbe, Mr. Daynes, Mr. Hawley, Lafayette Hanchett and Hyrum Silver will constitute the board of directors. Other stockholders are W. S. McCornick, W. P. Read, L. S. Cates, J. Frank Elam and E. E. Jenkins.

THE CRESCENT ELECTRICAL MANUFACTURING COMPANY, Rochester, N. Y., has recently moved into larger and more commodious quarters at 187 N. Water Street—a change which was made absolutely necessary by its rapidly increasing business. It will occupy the entire second and third floors, with 10,000 sq. ft. of working space, in the new quarters. The offices, engineering and drafting departments are in the front of the second floor, the remainder of the space being devoted to assembling work, storing and shipping. The heavy machinery is located on the third floor and there all raw material is stored. It will be remembered that this company devotes special attention to panel board work and in this connection it is making all-steel cabinets for panel boards, which are attracting a great deal of favorable comment. Among recent orders are all the panels and cabinets for the New York State Commission at Flushing and Binghamton and the Custodio Asylum at Rome. A seven-panel board is just being completed for the Stecker Mfg. Company of Rochester.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, manufacturer of the Exide battery, has produced in the 1906 model of the "Exide" sparking battery one built to give satisfactory service with a minimum amount of attention. In this latest model it has provided against "sparking battery troubles." The plates are strongly burned to the connecting straps to insure against broken joints. Special care has been taken in designing the terminals, they being cast in lead pillar straps which extend through holes in the cover of the case, and the holes being fitted with rubber gaskets to prevent the acid from creeping up and corroding the terminals. The rubber jars are of the best quality to withstand breakage, and the sealing is tight and durable. These sparking batteries are supplied with either gelatinous or liquid electrolyte, as ordered. The cases are made of cherry, finished in either natural wood or in black, treated with an acid resisting composition. A sliding cover is used which gives ready access to the cells.

STANLEY-G. I. COMPANY.—Various changes will take place on the first of April in the personnel of the Stanley-G. I. Electric Mfg. Company's representation on the Pacific Coast. Mr. F. V. T. Lee has resigned the position of district manager to become assistant to the president, Mr. John A. Britton, of the Pacific Gas and Electric Company. Mr. H. C. Parker, who has been manager of the San Francisco office, will become acting district manager and Mr. G. I. Kinney, who has been manager of the Seattle office, will be associated with Mr. Parker with headquarters at San Francisco. Mr. Lee's connections with Stanley interests on the Pacific Coast date back to the organization of the firm of Jno. Martin & Co., who were for many years, especially during the time of the pioneer long-distance electric transmission work of that section, the Stanley Company's Pacific Coast representative. Messrs. Parker and Kinney were also associated with the Martin Company prior to the time of the company's establishing its own branch offices on the Pacific Coast.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Ithaca, N. Y., May, 1906.

American Electro-Therapeutic Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Meetings, fourth Friday of each month.

American Railway, Mechanical & Electrical Association. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

American Society of Civil Engineers. Secretary, Chas. W. Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York. Next meeting, Chattanoga, Tenn., May 1-4, 1906.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Birmingham, Ala., Oct. 2-5, 1906.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, 60 Wall St., New York. Next convention, Columbus, Ohio, Oct. 15-20, 1906.

Association of Edison Illuminating Companies. Secretary, Geo. R. Stetson, New Bedford, Mass. Next meeting September, 1906.

Association of Railway Telegraph Superintendents. Secretary, P W. Drew, Milwaukee, Wis. Next meeting, Denver, Col., May, 1906.

Association of Electric Lighting Engineers of New England. Secretary, C. R. Brown, 516 Atlantic Ave., Boston, Mass. Annual meetings held in Boston on third Wednesday in March.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Niagara Falls, Ont., 1906.

Colorado Electric Light, Power & Railway Association. Secretary, George B. Tripp, Colorado Springs, Col.

Connecticut State Street Railway Association. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November, 1906.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, F. Fish, 123 Mill St., Rochester, N. Y. Next meeting, New York City, June 19, 1906.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary-Treasurer, Geo. H. Erich, 401 Monadnock Block, Chicago. Next annual meeting, Chicago, January, 1907.

Electrical Trades Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 1, 1906.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings second and fourth Thursdays each month.

Electrical Trades Association of Canada. Secretary, Wm. R. Staveley, Royal Insurance Building, Montreal, Can. Next annual meeting, Jan. 14, 1907.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electric Association. Secretary, T. R. Beal, Poughkeepsie, N. Y. Annual meeting, October, 1906.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

Indiana Electric Railway Association. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Thursday of each month.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, New Haven, Conn., Aug. 16-18, 1906.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Des Moines, April 19 and 20, 1906.

Iowa Electrical Association. Secretary, George S. Carson, Iowa City, Ia. Next meeting, Des Moines, April 18 and 19, 1906.

Iowa Telephone Association. Secretary, C. C. Deering, Boone, Ia. Next meeting, Des Moines, March 13, 14 and 15, 1906.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Lawrence, Kan., October, 1906.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

Maine Street Railway Association. Secretary, E. A. Newman, 471 Congress St., Portland, Me.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electric Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Oct. 16, 1906.

Missouri Independent Telephone Association. Secretary, James F. Barnett.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, June 14, 1906.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y. Next meeting, Cleveland, O., July 18, 1906.

National-Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn. Next meeting, Chicago, June 26, 27 and 28, 1906.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Twenty-ninth Convention, Atlantic City, N. J., June 5-8, 1906.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty Street, New York.

New York State Independent Telephone Association. Secretary, T. S. Lane, 536 Ellicott Square, N. Y. Next meeting, Elmira, N. Y., June, 1906.

Northwestern Electrical Association. Secretary, B. C. Adams, Madison, Wis.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Put-in-Bay Island, Aug. 21-23, 1906.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, O. Annual meeting, Columbus, March 30, 1906.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, F. W. Bullard, Cleveland, O. Next meeting, Pittsburg, Pa., May 17, 1906.

Ohio Street Railway Association. Secretary, Chas. Currie, Akron, O.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Washington, D. C., Oct. 9, 10 and 11, 1906.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore. Next annual meeting, June 19, 1906.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

Pennsylvania State Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings second Saturday of each month.

South Dakota Telephone Association. Secretary, H. B. Hartwell, Irene, S. D.

Southwestern Electrical and Gas Association. Secretary, Frank P. Duffy, Beaumont, Tex. Next meeting, May 16, 17 and 18, 1906.

Street Railway Accountants' Association of America. Secretary, E. M. White, Box 345, Hartford, Conn.

Street Railway Association of the State of New York. Secretary, C. B. Fairchield, Jr., 114 Liberty St., New York.

Underwriters' National Electric Association. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

Vermont and New Hampshire Independent Telephone Association. Secretary, G. W. Buzzell, St. Johnsbury, Vt. Next meeting, July 10 and 11, 1906.

Vermont Electrical Association. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt. Next meeting, St. Johnsbury, Vt., September, 1906.

Western Society of Engineers, Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MARCH 27, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

815,942. METHOD OF ABSORBING GASES OR VAPORS AND THE PRODUCTION OF HIGH VACUUMS; James Dewar, Cambridge, England. App. filed Apr. 25, 1905. A method of absorbing gases or vapors by exposing to the gas charcoal cooled to a temperature comparable with that at which the gas to be absorbed boils, substantially as described.

815,961. ELECTRICAL DEVICE AND CIRCUIT; William H. Lane, Westfield, New Jersey. App. filed June 2, 1905. Aims to overcome a defect of present railroad signal systems due to the sticking of the relay armatures caused by the fact that the rails are short circuited by the trains at a point remote from the relays. Patentee cuts out one coil of the relay when the armature is in attracted position.

815,964. ELECTRIC FUSE; Benjamin Luther, Boston, Mass. App. filed Apr. 24, 1905. A device for securing the metallic caps to the fiber tubes of ordinary enclosed fuses. The patentee insets prongs or barbs in the caps to engage the fiber and hold the caps in place.

815,985. METHOD OF MAKING ARMOR PLATE; Joseph Strauss, Washington, D. C. App. filed Mar. 31, 1905. The method of making armor plate, which consists in electrically welding two metal plate-form members of different degrees of hardness.

815,991. TROLLEY-POLE; Andrus S. Weaver, Sodus, N. Y. App. filed January 7, 1905. An arrangement for causing the trolley pole to drop if the wheel leaves the wire. For this purpose the upper end of the pole is hinged to the body thereof, and the relative movement causes the pole drop when the wheel leaves the conductor.

815,993. TRANSFER-SWITCH FOR TESTING CIRCUITS; John S. Witaker, Portsmouth, N. H. Designed to supply current to a signaling system. The device is arranged to normally connect the usual power means to the circuit, but in case of failure of the power voltage, the signal circuit is automatically connected on to a battery source of potential.

815,996. RHEOSTAT; Charles Wirt, Germantown, Pa. App. filed January 10, 1905. A method of manufacturing resistance coils which consists in winding the coil and placing it in a suitable mold and then injecting plaster of paris into the mold, so as to solidly support the resistance wire.

816,000. COMBINED TELEPHONE AND WATCHMAN'S ALARM SYSTEM; John J. Berry, Indianapolis, Ind. App. filed Jan. 3, 1905. The combination, with an electrical-energy telephone, its service-circuit and switchboard connections, of a watchman's recording means normally electrically connected to said service-circuit, a central-recording means electrically connected to said service-circuit, an alarm-signal and its controlling circuit, means for intermittently operating the alarm-signal through its controlling circuit, and means controlled by the watchman's reporting means for preventing the normal operation of the alarm-signal.

816,014. SAFETY SYSTEM FOR ELECTRIC-ROAD CROSSINGS; Arthur H. Johnson, Rahway, N. J. App. filed December 5, 1892. Renewed Feb. 8, 1906. At either side of the crossing of a street and a steam railroad, the usual trolley forms a local insulated section, and the power is cut off from said section by an attendant when there is danger from a passing locomotive.

816,028. ELECTRICAL SWITCH; James F. McElroy, Albany, N. Y. App. filed April 30, 1903. Details of a circuit breaker or cut-out, the essential feature of which is the blade element of the switch which has a pair of spring contacts in its face adapted to yield in a direction transverse to the motion of the blade.

816,033. ROSETTE FOR ELECTRIC-LIGHT WIRES; John Henry Parker, Saugus, Mass. App. filed Feb. 20, 1905. Details of a rosette having a circular base from which depends an arch beneath which the connections are made and through which the wires extend to the lamp.

816,052. TELEPHONE EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Dec. 3, 1903. In a telephone-exchange system, the combination with a telephone-line extending from a substation to an exchange of cord connecting apparatus for connecting said line with another for conversation, a common source of current at the central exchange for supplying talking and signaling current to the cord-circuit and telephone lines, a circuit extending between one pole of said source of current and one cord strand, and including a supervisory lamp and an impedence coil, a second circuit extending from the same pole of said source to the other cord strand and including only the winding of the supervisory relay, connection of said cord circuit with the telephone line causing the circuit through said supervisory lamp to be completed, and actuation of sub-station apparatus upon connection of the cord circuit with the line causing the circuit through the supervisory relay to be completed and the circuit through the supervisory lamp open.

816,078. TELEPHONE EXCHANGE SYSTEM; William M. Davis, Chicago, Ill. App. filed Aug. 5, 1901. In a telephone exchange system, the combination with a telephone line extending from a subscriber's substation to a central exchange, a plurality of spring jacks of a multiple switchboard normally discontinued from the line limbs, a single common source of current at the central exchange, a line relay normally connected with the line limbs through said source of current, a cut-off relay having a single winding, one terminal of said cut-off relay being connected with one terminal of said source and normally with one line limb, the other terminal of the cut-off relay being connected with spring-jack contacts, a cord-circuit for connecting telephone lines together, actuation of substation apparatus causing energization of said line relay independently of the cut-off relay winding, and means upon connection of said cord circuit with one of said multiple sections for closing a local circuit containing said cut-off relay winding and said source of current whereby said cut-off relay is energized to disconnect said line relay from circuit, and to connect the spring-jack contacts with the line-limbs, said local circuit including one of the cord-circuit conductors and one limb of the telephone circuit.

816,100. ELECTRIC SWITCH; Montgomery H. Johnson, Utica, N. Y. App. filed April 20, 1903. The switch blade is operated by a compound lever which initially moves the blade into engaging relation with the contacts and subsequently presses it thereagainst.

816,111. REVERSE-RELAY DEVICE; Ralph D. Mershon, New York, N. Y. App. filed November 4, 1904. A system of connections including transformers and wattmeter coils for operating a circuit breaker when certain abnormal conditions occur in a line where two or more sources of current feed into the same circuit.

816,112. CIRCUIT-CONTROLLING APPARATUS; Ralph D. Mershon, New York, N. Y. App. filed December 27, 1904. In order to secure sufficient energy to operate a circuit breaker by a light vibrating lever which makes only a temporary contact, the patentee provides a local magnet which is capable of holding the lever permanently against the contact after it has once moved thereagainst.

816,131. TRANSFER-CIRCUIT FOR TELEPHONE EXCHANGE SYSTEMS; Charles A. Simpson, Chicago, Ill. App. filed Oct. 27, 1904. In a telephone system, the combination with subscribers' lines terminating upon different switchboard sections, of a transfer circuit extending between said sections, means at each said section to connect the subscribers' lines thereof with the said transfer circuit to establish a complete talking circuit between the subscribers, two signals permanently connected in parallel associated one with each end of the said transfer circuit, and means actuated in making and unmaking connections with the said transfer circuit for suitably controlling the circuit of said signals, substantially as described.

816,132. TELEPHONE SYSTEM; Charles B. Smith, New York, N. Y. App. filed Nov. 28, 1898. A telephone system comprising a central office and a party-line leading therefrom having a plurality of conductors, telephone and signaling instruments for connection with one conductor, and electrically operating devices adapted to operate one at a time and successively for selecting and placing in circuit the signaling instrument desired and for restoring the circuits to their normal conditions, means at central for sending the appropriate impulses over the conductors to select and operate the signaling instrument desired and for restoring the circuits, means at central for joining two of said conductors in a closed metallic circuit through the telephone instruments, and means corresponding with each telephone for signaling to central over such metallic circuit to notify central to disconnect the circuits.

816,135. TELEPHONE EXCHANGE SYSTEM; Harold B. Stroud, Chicago, Ill. App. filed March 25, 1901. The combination with telephone lines extending from subscribers' stations and passing serially through two boards at the exchange, each line having a switch connection with each board, of trunk circuit connecting means interposed between the boards, line indicators at one of the boards, test indicators associated with the telephone lines at the other board, a source of current for the trunk circuit, and means whereby the said test indicators are operated by said source when the trunk circuit is connected with the line at the first board, connection of said circuit also mechanically causing restoration of the line indicator.

816,139. RAILWAY CAR AND LOCOMOTIVE HEADLIGHT; Adolph Walter, Toledo, Ohio. App. filed Dec. 18, 1901. A switch arm is mechanically connected to the throttle of a locomotive so as to close the circuit through the locomotive headlight when the throttle is opened and thereby give an indication that the train is in motion.

816,142. PROCESS OF MAKING IRON FROM THE ORE.; Robert H. Aiken, Winthrop Harbor, Ill. App. filed June 1, 1903. The method of making iron from iron oxids which consists of dissolving the oxid in a molten silicate of one or more metals not less electropositive than iron, and passing through the solution a continuous current adapted to decompose said oxid.

816,148. TROLLEY-SHIELD; John W. Brown and Charles W. Jenkins, Washington, D. C. App. filed Apr. 29, 1905. A curved guard surrounds the trolley wheel in such a way as to prevent it from catching on the wire when it has escaped therefrom and is being repositioned by the retriever or other means.

816,172. ELECTRIC HEATER; Harmon N. Morse and Joseph C. W. Frazer, Baltimore, Md. App. filed Apr. 18, 1905. A form of resistance element comprising a block of soap stone which is painted with a layer of mixed graphite and clay. The current is conducted through this layer or coating.

816,192. ELECTRICAL GENERATOR; William Stanley, Great Barrington, Mass. App. filed Feb. 17, 1904. Renewed Nov. 11, 1904. Has fields which are energized by an alternating current and a specially wound armature from which can be obtained alternating currents of different frequency.

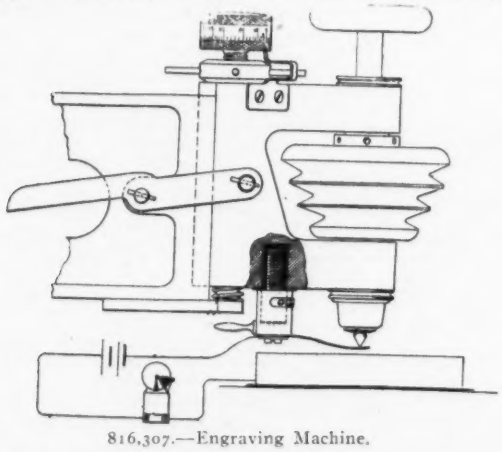
816,205. WIRELESS-TELEGRAPH RECEIVING APPARATUS; Allesandro Arton, Turin, Italy. App. filed Sept. 7, 1905. A pair of antenna are supported at an angle to one another and are so connected to the coherer as to respond to polarized but not unpolarized radiations.

816,239. TROLLEY-HARP; Isaac H. Lunt, Barre, Vt. App. filed Sept. 6, 1905. The trolley harp is hinged at the upper end of the pole to have an independent transverse movement, the purpose of which is to facilitate rounding curves.

816,259. AUTOMATIC GEARING DEVICE; Judson Shoecraft, Eskridge, Kan. App. filed Nov. 9, 1905. Details of a semaphore operating mechanism in which the semaphore is raised by a motor-driven gear train and falls by gravity when disengaged by a release magnet.

816,270. REFRACTORY MATERIAL FOR ELECTRIC INSULATION AND OTHER PURPOSES. Demetrius M. Steward, Chattanooga, Tenn. App. filed Feb. 25, 1903. An insulating and refractory material comprising the combination of water glass and steatite or their substantial equivalents, chemically converted practically to a complete extent by heat.

816,307. ENGRAVING MACHINE; William E. Eaton, Sag Harbor, N. Y. App. filed Aug. 23, 1905. In order to properly position a tool of an engraving machine with reference to the work the patentee interposes a strip of known thickness beneath the tool, and adjusts the elevation of the tool until an electric circuit is completed through the strip.



816,307.—Engraving Machine.

816,375. ELECTRIC METER; Wm. H. Pratt, Lynn, Mass. App. filed July 25, 1904. A system for measuring the energy of a three-phase system using a neutral return wire in which a single rotating element has two armatures rotating in separate fields and the connections are made in different branches so as to properly indicate the energy of the circuit.

816,383. MOTOR-STARTER; Ernest Schattner, Schenectady, N. Y. App. filed July 20, 1905. A system of contactors supported on a single base and adapted to be successively actuated by connections depending on the counter e.m.f. of the motor. Is adapted for small motors and small insulations as well as large ones.

816,384. BATTERY; Eugene W. Schneider, New York, N. Y. App. filed Aug. 11, 1905. A battery composed of a plurality of cells and means whereby one of said cells by an end-to-end reversal thereof may be thrown into or out of the generating circuit of the battery.

816,395. ALTERNATING CURRENT GENERATOR; Charles P. Steinmetz, Schenectady, N. Y. App. filed July 25, 1904. In an alternating current generator, a field structure provided with a distributed winding and a many part commutator connected thereto, brushes bearing on said commutator, means for supplying direct current to the field to magnetize the field structure on a line fixed relatively thereto, and means for supplying to said brushes a curent varying in magnitude and phase with the armature current.

816,406. FUSE-PLUG; August Weber, Sr., and August Weber, Jr., Schenectady, N. Y. App. filed March 8, 1904. A form of fuse plug formed of a single hollow block containing a ledge over which the fuse wire passes in its path from the threaded shell to the central stud.

816,407. ELECTRIC PRESSURE INDICATOR; Joseph H. Wertz, New Haven, Pa. App. filed March 21, 1905. A U-shaped tube contains mercury and a pair of circuit connections which establish separate alarm circuits by the rise of the mercury column in one tube or the other, depending on pressure variations.

816,415. TROLLEY; Henry Zander and Gustav Hahn, Wilmerding, Pa. App. filed Sept. 25, 1905. A pair of curved arms are hinged upon the sides of the harp as to normally close over the wheel and prevents its escape from the wire. The arms can be separated when desired by a cord connection.

816,428. ELECTRIC CABLE; Harold W. Buck, Niagara Falls, N. Y. App. filed July 27, 1904. In order to fire-proof telephone cables properly the patentee wraps them with asbestos tape which has been specially treated with silicated soda, after the cables are in position in the conduit.

816,429. DEVICE FOR SUPPORTING CABLES OF ELECTRIC LAMPS; James F. Burns, Albany, N. Y. App. filed July 12, 1905. The lamp cord is coiled upon a spring dam which can be held in any position by a magnet-operated detent. The detent is made operative whenever the light is turned on.

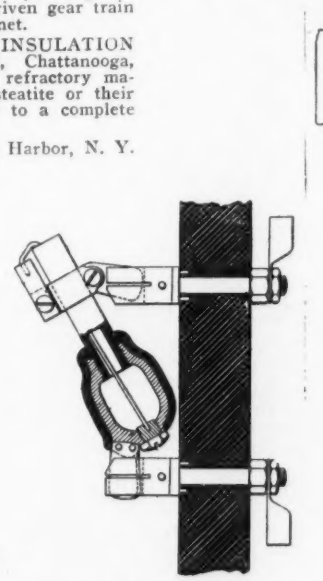
816,436. ELECTRIC-LIGHT SOCKET AND KEY; Owen C. Cover, Goshen, Ind. App. filed Nov. 12, 1904. An attachment for an ordinary lamp socket by means of which the lamp and another lamp can be thrown into series or multiple with one another, securing brilliant or dim illumination.

816,442. SYSTEM OF ELECTRICAL REGULATION; William L. R. Emmet, Schenectady, N. Y. App. filed July 1, 1904. The combination of an alternating current generator having alternating-current mains leading therefrom, and having a direct-current exciting circuit connected thereto, a source of exciting current connected to said exciting circuit, a booster interposed in the exciting circuit and a regulator for said booster responsive both to the voltage of the alternating-current mains and to the resultant voltage of said exciting source and booster.

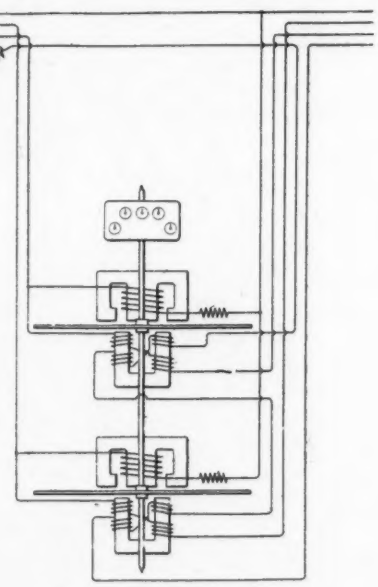
816,443. EXPULSION FUSE; Charles E. Eveleth, Schenectady, N. Y. App. filed May 14, 1904. An enclosed fuse is formed with a large cavity at one end, the other end being open, so that the arc is blown out at the open end by the expansion of gases in the cavity.

816,444. ELECTRIC SWITCH; Augustine R. Everest and Ralph E. Baker, Lynn, Mass. App. filed Sept. 14, 1903. A snap switch for making a number of circuit connections. The switch arm and handle are spring-connected and the arm follows the handle by an abrupt movement in passing from one contact to another.

816,465. FIRE ALARM BOX; Stephen J. Heinrich, Bellevue, Pa. App. filed Apr. 26, 1904. Details of a fire-alarm system in which all the instruments of the line are cut out of action whenever an alarm is given from any station.



816,443.—Expulsion Fuse.



816,375.—Electric Meter.

816,467. SYSTEM OF TROLLEY WIRE SUSPENSION; Paul E. Herkner, Berlin, Germany. App. filed Sept. 10, 1904. A trolley system for high-speed trains in which the hangers at the curves have short arms or rods connected with the trolley wire which permit a slight upward yielding thereof when the train passes.

416,468. MAKING AND BREAKING HIGH-POTENTIAL CIRCUITS; Edward M. Hewlett, Schenectady, N. Y. App. filed Dec. 14, 1898. In order to avoid the destructive oscillations of current which occur in high potential systems when the circuit is abruptly broken, the patentee provides a heavy inductance which is gradually varied in opening or closing the circuit, so as to avoid any sudden variation.

816,469. FUSE BOX; Edward M. Hewlett, Schenectady, N. Y. App. filed May 14, 1902. A fuse box comprising four corner studs which are vertically and horizontally channelled so as to receive mica plates.

816,482. APPARATUS FOR BLEACHING AND STERILIZING. Sidney Leetham, York, England. App. filed July 16, 1904. In apparatus for bleaching and similar operations the combinations of an ozonizer, a sparking discharge apparatus and a high-tension electric circuit including in series both the ozonizer and the sparking discharge apparatus.

816,483. HOLDER FOR ELECTRIC INCANDESCENT LAMPS; Peter Leonard and Charles Harold Jones, Great Crosby, near Liverpool. England. App. filed Feb. 17, 1904. An arrangement for securing lamps in outdoor positions so as to avoid exposure of any metallic parts to the weather. The socket has a rubber packing ring arranged to be closely pressed against the glass of the bulb and preclude any moisture entering the socket.

816,484. AUTOMATIC CARRIER; Sam H. Libby, East Orange, N. J. App. filed Sept. 1, 1904. A telpherage system in which the telpher cars have switches thereon which are received into forks or yokes at the stations so as to be actuated thereby for the purpose of obtaining a hoisting or lowering of the telpher buckets.

816,511. DYNAMO ELECTRIC MACHINE; Charles P. Steinmetz, Schenectady, N. Y. App. filed Jan. 28, 1905. In a dynamo-electric machine, a slotted armature, a winding in the slots, a commutator, and bifilar resistances supported in holes in the armature body independent of said slots and inserted in the connections between said windings and the commutator segments.